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Getting your cows into calf: the options

1. Breeding options for cattle

PRODUCTION of calves is the cornerstone of any cattle or dairy operation. As the next breeding season approaches, key mating decisions have to be made. Often, the desired reproductive outcome is to get as many breeding cows and heifers into calf as possible, often within the shortest possible time.

To achieve desired conception and calving rates, three major options can be used to get cows pregnant on the farm. These options include use of herd bulls (natural service, NS), artificial insemination (AI), and a combination of AI and herd bulls (AI + NS). In this article, we review how each of these mating options work towards the goal.

2. Use of herd bulls

Use of natural service (NS) is the most frequently used breeding method on beef farms. Bulls are generally one of cheapest and best investments in a commercial cow herd. With herd bulls, labour and logistical requirements to supervise the breeding program are lower. Conception rates depend on such management variables as bull-to-cow ratios, length of the breeding season, breeding soundness of bulls, and relationships among breeding animals.

Often bulls and cows are combined in single or mixed size groups mating during a 90-120 day breeding season (BS) or all year round. Mating ratio is typically one bull for every 25–35 cows. However, this ratio can vary based on factors such as bull age, fertility, and pasture size. A lower ratio is associated with lower conception rates, and higher ratio with under-utilised bulls and higher bull costs per calf sired. Bulls must be regularly checked for breeding soundness, and vaccinated against venereal diseases before the breeding season.

However, each year a large proportion of naturally-sired cows remain non-pregnant. A study by researchers at Chinhoyi University of Technology (Gororo et al 2017) revealed that farmers face challenges related to availability and access to affordable good quality bulls. In addition, it was observed that farmers have too few cows to warrant individual purchase and ownership of breeding bulls.

This situation culminates in observed poor reproduction outcomes, particularly on smaller farms, and those using communal grazing. For instance, the study reported high age at first calving (APC, 31-36 months), low calving rates (CR, 38-40 percent per year), and long intervals between successive calves (ICP, 19-24 months) for smallholder cattle herds. These performance indicators were related to bull ownership, access, and quality.

3. Use of artificial insemination (AI)

Many cattle farms are increasingly adopting the use of AI in their breeding programs. The AI option can be used to complement or substitute NS bulls, depending on farmer circumstances. Individual farmers or groups can access the AI service via three main routes: the centralised government service; the do-it-yourself (DIY) model; and use of private AI Service Providers (AISP).

Compared with NS, the benefits from use of AI are tied to better conception rates, efficient use of resources and genetic progress. A good AI program can achieve conception rates of 50-55 percent (beef cows) and 60-70 percent (dairy cows) or higher per insemination.

With AI, the risk of introducing or spreading reproductive diseases in the herd is almost zero. Farmers neither incur ownership costs, nor face safety risks associated with having live bulls on the farm. Instead, the farmer pays only per service of each cow. Our analysis for a medium scale farm showed lower bull costs per calf AI, relative to herd bulls (Zimpapers Agriculture Journal, Issue 12: October 2023).

Other economic benefits of AI stem from flexibility in the bulls that can be used each breeding season. High quality, productive cows are reared from use of semen from superior or proven bulls with desirable traits. Shorter, more concentrated calving seasons, uniform calf crops, and higher weaning weights are further benefits of AI relative to NS.

However, farmers should understand that conception rates from AI depend on the interplay between four major variables. These are: heat detection efficiency; fertility of the cows; viability of the semen; and proficiency of the inseminator. Poor performance in any of these variables has a huge negative impact on achieved conception rates. The fertility of cows and the ability to detect them when in heat are the most important variables under the management control of the farmer. Fertility status is a function of the genetics, feeding and nutrition, body condition score, and health status of the cows.

AI programmes in beef herds are often hampered by practical challenges of heat detection. This is less a problem in dairy herds. Heat detection failure comes from factors such as post-partum anoestrus, silent heats, missed heats and confused heat signs. To overcome these problems, a farmer may elect to synchronise heat so that cows can be inseminated at a predetermined time. This is termed fixed-time artificial insemination (TAI).

A Brazilian study compared performance of programs that used natural service (NS), AI after natural heat detection (ED+AI), and fixed time AI (TAI) in suckled beef herds (Sá Filho et al 2013). Relative to NS, cows bred through TAI calved earlier in the season, had higher conception rates, and weaned heavier calves. Regarding reproductive efficiency, the study found (i) NS to be more efficient than ED+AI, and (ii) TAI to be more efficient than NS.

4. Combining TAI with herd bulls

In this option, a farmer uses fixed time AI at the start of the breeding season, and clean-up bulls to cover those cows and heifers that could not take to the insemination. Basically, after the first synchronized AI service, bulls are introduced until the end of the breeding season.

When AI and NS bulls are used in combination, conception rates can be quite high. In another experiment, cows were randomly assigned to herd bulls (NS) or fixed time AI followed by cover bulls (TAI + NS) over a 90-day breeding season (Baruselli et al 2016). Cows in the TAI + NS group had 63 percent higher likelihood of conception and fewer median days to pregnancy (15 vs. 35 days). Conception rates were higher for TAI + NS compared to NS (77 percent vs. 71 percent), though this difference could not reach statistical significance.

As a consequence, cows exposed to TAI followed by NS had shortened calving seasons, produced uniform calf crop, weaned heavier calves, and had higher chances of re-conception in the subsequent breeding season (Figure 1).

An effective TAI + AI program can easily reduce bull needs in half offsetting the investment in AI. This can be a good breeding strategy for large farms with fewer bulls relative to the number of cows. Bull-to-cow ratios may be reduced to 1:60-70 without negatively affecting conception rates, when TAI is used at the beginning of the breeding season.

5. Conclusions

The common breeding system for cow-calf producers in Zimbabwe is use of herd bulls, also known as natural service. Artificial insemination following heat detection or synchronisation is increasingly being adopted by a large number of producers. AI can be used solely or in combination with herd bulls to achieve high conception rates, shorten calving periods and make the reproduction program more efficient. Cattle producers must rethink their breeding strategy this coming season.

About the author

Eddington Gororo is an animal scientist, researcher and academic. His career goal is to help people build better, more productive and resilient agriculture business through synergistic and context-specific technological applications. He can be contacted on +263 77 398 6735 or gorroeddington@gmail.com

Figure 1 Survival curves for proportion of non-pregnant cows for suckled beef cows bred by natural service (NS; N = 255) or by timed AI (TAI) at beginning of the breeding season followed by NS (TAI+NS; N = 252). (Source: Sá Filho et al 2013)
PRESS STATEMENT

RESOLUTIONS OF THE MONETARY POLICY COMMITTEE MEETING HELD ON 23 OCTOBER 2023

The Monetary Policy Committee (the MPC) of the Reserve Bank of Zimbabwe (the Bank) met on 23 October 2023 and deliberated on recent macroeconomic and financial developments in the economy.

The MPC was pleased with the relative exchange rate and price stability obtaining in the economy since June 2023. The MPC noted, with emphasis, the need to ensure that inflation expectations continued to be firmly anchored through urgent attention to any emerging risks. The MPC also noted that there was need to continue promoting solutions that were aligned with the digital space and plastic money environment that the country found itself in and, in that regard, the MPC applauded the Bank for continuing to engender financial inclusion in a market-based and cash-lite driven economy.

The MPC noted that the negative impact of emerging global risks, including subdued global growth emanating from geo-economic fragmentation and the effects of tight monetary policy, high interest rates, credit squeeze and low international commodity prices, could pose significant risks to the current stability in the domestic economy. Global growth was expected to slow down from 3.5% in 2022 to 3.0% in 2023 and to 2.9% in 2024, which is far below the historical average of 3.8%.

Due to the negative developments in the global economy, prices for most mineral commodities including platinum, nickel and lithium have been declining, negatively affecting export receipts in the economy. As a result, export receipts, which are the main source of foreign currency for both the wholesale and retail foreign exchange auctions and for servicing the country’s foreign commitments, fell by 9% over the nine months to September 2023, from US$4.5 billion during the comparable period in 2022 to US$3.6 billion.

Considering the emerging global risks and the need to keep exchange rate and inflation expectations anchored to support economic growth, the MPC made the following resolutions:

**Interest Rates**
With immediate effect, the Bank Policy rate has been reduced from 150% to 130% per annum and the Medium-term Bank Accommodation (MBA) interest rate for the productive sectors including individuals and MSMEs will be maintained at 75% per annum.

**Foreign Currency Retentions**
With effect from 1 November 2023, foreign currency retentions on exports shall be standardised at the level of 75% across all sectors of the economy and all special dispensations granted to some sectors of the economy shall be removed. The net effect of this measure is to increase foreign exchange resources available to the Bank and Government to meet foreign exchange requirements for the settlement of national and international obligations.

**Promotion of No-Frills (Low-Cost) Bank Accounts**
Financial institutions are encouraged to scale up financial inclusion through opening of more no-frills (low-cost) accounts. This measure will promote more use of banking services and financial products, including increased use of bank cards, digital financial services and other cash-lite means of payments in the economy. In order to complement efforts to formalise the economy and to give more impetus to the use of non-cash-based means of payment in the economy, it is recommended that Government considers removing Intermediated Money Transfer Tax (IMTT) on transactions that are intermediated through plastic bank cards and other digital platforms.

**Trading Margins**
In order to support the continuous fine-tuning and further liberalisation of the foreign exchange market, with a view to guaranteeing and safeguarding exchange rate stability, it is recommended that the limit of 10% trading margin above the interbank rate be removed.

**Zimbabwe Gold (ZiG)**
Since its introduction as a medium of exchange on 5 October 2023, the use of ZiG has been embraced widely in the economy and its continued dual use as a value preserving instrument and a medium of exchange in the economy will go a long way in supporting digitisation, financial inclusion and the overall stability of the local currency.

The MPC will remain alert to attend to any emerging risks, emanating from both the domestic and international fronts, in its commitment to ensuring stability in the exchange rate and general price levels.

John P Manguudy
Governor
24 October 2023
I understand why some have already planted while others are waiting for the second offering. The Meteorological Services Department (MSD) immediately advised that the rains did not signal the start of the 2023/24 season hence farmers should delay planting. They were very clear in their message that only those in areas prone to waterlogging could go ahead and plant alongside those with irrigation facilities.

This, said MSD, would ensure that in the event of a prolonged dry spell past the projected 10 to 20 days of rainfall inactivity, plants could survive on moisture locked up in the soil or on irrigation supplements. To me the advice made sense because if you are situated in areas with heavy soils that need a lot of rains and have planted with the rains that fell recently and your crop germinated, you must be fervently praying that there will not be a prolonged dry spell because you will soon be contending with re-planting costs.

This is not a good thing to do, if you know what I mean. You do not need to start the season on a losing note. At least it will make sense if the predicted El Nino weather catches up with you at some point and not from the word ‘GO.’ I am not a weather expert and cannot tell how our season will unfold. I also cannot make the decision not to plant or to plant on your behalf but am only laying bare what our weather people are saying.

GREETINGS!!! I have been doing a lot of thinking about what to talk to you about this time around. I hope you will appreciate the fact that I am coming to you at a time when anxieties are running high in the farming communities in the wake of the recent rains. Some of you were blessed with rains in excess of 25mm, which was enough to leave you convinced the season had started.

THE Zimbabwean agricultural sector is becoming increasingly sensitive to risks, particularly significant weather unpredictability. The most serious threat to Zimbabwe’s agricultural productivity is erratic rains punctuated by severe droughts. Drought is a serious agricultural concern that affects both crops and livestock.

The last episode of an El Nino-induced drought was witnessed in 2018/19, leaving over 5 million people in the country food insecure. It affected and caused widespread crop failures and livestock deaths.

The maize harvest, which is the country’s staple food crop, went down by 34 percent compared to the previous season. The effects of the drought were exacerbated by the country’s economic crisis, which made it difficult for farmers to access inputs and credit.

Against the backdrop of a changing climate, agriculture insurance has become an essential adaptation and mitigation tool as it allows farmers to manage the risks associated with rain-fed agriculture, on which, the bulk of our smallholders’ farmers rely.

What is Agriculture Insurance?

In general, insurance is a form of risk management used to hedge against a contingent loss. The everyday definition is the equitable transfer of a risk of loss from one entity to another in exchange for a premium or a guaranteed and quantifiable small amount to prevent a large and possibly devastating loss.

Agricultural insurance gives farmers protection from financial losses caused by unfavourable weather events such as floods or droughts, pests, and diseases, and makes it easier for farmers to reinvest in agriculture by providing financial assistance in the event of crop or livestock failure. This form of insurance is not only limited to crop and livestock indemnification, but it also applies to plantations, aquaculture, bloodstock, horticulture, farm implements, and farm structures. In essence, agricultural insurers desire to provide a solution for almost all the risks faced by a farmer.

In addition to the direct benefits of insurance, subscribing to an insurance policy can provide farmers with financial security when accessing agricultural loans. For example, a farmer wishing to finance his 100-hectare maize crop through a bank loan can take out a crop insurance policy and a loan protection policy. In the event of a fire ravaging the entire crop, the farmer can claim compensation from the insurance company and use the proceeds of the claim to settle his obligations with the bank. On the other hand, the loan protection policy will provide compensation to the financier if the farmer is unable to settle his loan due to disability or death. Agricultural insurance therefore helps minimise the risk of food insecurity and poverty by cushioning farmers from the financial burdens that can be occasioned by various kinds of insurable risks.

By mitigating risks, insurance companies contribute to the farmer’s personal growth and development.

Notwithstanding the notable advantages of agricultural insurance, there has generally been a very low uptake of this form of insurance, especially amongst smallholder farmers. This can mostly be attributed to the farmer’s having a limited understanding of the benefits, roles, and costs of agricultural insurance products as well as the eligibility criteria and claim settlement procedures.

This low uptake has been compounded by misconceptions about insurance, such as believing that it is expensive to buy insurance and that getting compensation from insurance is a complex and painstaking task. In addition, the limited availability and accessibility of insurance products and services, especially in remote and rural areas has been a significant challenge faced by smallholder farmers.

It is refreshing to note that the insurance industry in Zimbabwe is growing and gearing up to provide all sorts of agricultural insurance coverage. In general, there are insurance policies that cover losses for all field, horticultural, and plantation crops caused by uncontrollable pests and diseases, wind and hailstorm damage, drought, flooding, frost, fire and lightening, theft, malicious damage, explosion, windstorm, and loss or damage incurred during transportation of harvested crop to the market. In terms of premiums written, tobacco hail insurance is currently the most prominent form of crop insurance in Zimbabwe, increasingly we have started to witness growth in the uptake of other crop covers such as wheat, maize, sugar cane, sunflower, and soya.

Several measures are being implemented by insurers to increase insurance uptake, especially by smallholder farmers. Public awareness campaigns using information tools and vernacular languages that ensure broader coverage without segregation, development of new products to cater to low-income farmers, competitive pricing of products, and inclusion of agriculture insurance and risk management in the national training curriculum for Agritex officers are some of these initiatives. Efforts are also being made to include agricultural insurance and risk management in secondary school curricula, with the goal of building a knowledge-empowered future generation; and developing pool capacity for unique risks. There is also a thrust towards the use of technology to improve the efficiency of the crop and livestock insurance market such as the use of satellite imagery for weather index-based products. This will help to reduce the cost of providing insurance thus making it more affordable for farmers.

Through this journal, we will seek to educate the farming community on the insurance products available in the Zimbabwean market and help to demystify some of the common concerns and misconceptions around agricultural insurance.

Cuthbert Masulume is the General Manager for the AFC Insurance Company. AFC Insurance is a subsidiary of AFC Holdings, which is a diversified financial holdings group with an interest in commercial banking, development finance, farm mechanisation, and insurance. He is a seasoned insurance professional with considerable experience across all classes of insurance.
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Goat production in Zimbabwe: the facts

Nyasha Muchemeyi

ZIMBABWE, a country known for its rich biodiversity and diverse ecosystems, is home to a significant population of goats. These humble creatures not only provide sustenance and economic opportunities for rural communities but also play an important role in maintaining grassland ecosystems and conserving biodiversity. In this article, we delve into the diverse aspects of goat rearing in Zimbabwe and explore how these animals contribute to livelihoods, sustainability, and biodiversity conservation.

Livelihoods and Economic Significance: Goat rearing has been a traditional practice in Zimbabwe, deeply rooted in rural communities. Goats provide an important source of livelihood for many households, particularly in marginalised and remote areas. They serve as a low-cost investment, requiring minimal inputs while offering multiple economic opportunities. Goats are often relied upon for meat, milk, and other by-products which can be consumed or sold in local markets. Moreover, the sale of goats and their products provides rural farmers with necessary income to meet their basic needs, purchase necessities, and invest in education or other income-generating activities.

Environmental Sustainability: Goats are considered “browsers” rather than “grazers,” meaning they selectively consume leaves, twigs, and shrubs rather than solely relying on grass. This characteristic makes them excellent natural agents in controlling the spread of invasive plant species.

Nutritional Benefits: Goat meat is a significant protein source in many Zimbabwean diets, especially in rural areas where other sources of animal protein might be inaccessible or unaffordable. Compared to other meat sources, goat meat is often preferred for its lower fat content and unique flavour. Additionally, goat milk is known for its high nutritional value and has been used to address malnutrition and serves as an alternative for those lactose intolerant. The utilisation of goats for meat and milk production not only enhances household food security but also contributes to the overall nutritional well-being of communities.

Climate Resilience: Zimbabwe, like many other countries, is susceptible to climate change and its adverse effects. Goats have shown remarkable resilience to climate variability and are able to adapt to harsh conditions such as droughts, limited water availability, and extreme temperatures. As a result, farmers who rear goats are better equipped to face the challenges posed by climate change. Their ability to survive in such conditions makes goat rearing a climate-smart approach, as it reduces vulnerability and enhances the resilience of rural communities.

The significance of goats in Zimbabwe extends beyond mere livelihood. As agents of biodiversity conservation and contributors to the sustainable use of natural resources, goats play a vital role in maintaining ecosystem health and resilience. Their ability to control invasive plant species, provide nutritional benefits, and withstand climate variability showcases their importance in supporting rural communities and promoting the well-being of both people and the environment. As Zimbabwe moves forward, it is crucial to recognise and appreciate the multifaceted contributions of goats, ensuring their inclusion in sustainable development and conservation efforts.

There are several factors that can affect the production of goats. Here are some of the key factors to consider:

- **Genetics:** The breed of goats you choose plays a significant role in their production capabilities. Some breeds are better suited for meat production, while others excel in milk production. Selecting the right breed with desirable traits can greatly impact productivity.

- **Housing and environment:** Goats need well-designed and spacious housing facilities that provide adequate ventilation, protection from extreme weather conditions, and hygiene. A healthy environment promotes better growth, reproduction, and overall productivity.

- **Health and disease management:** Regular vaccinations, deworming, and healthcare checks are important in preventing diseases and maintaining optimal goat health. Good management practices, such as maintaining cleanliness, proper sanitation, and quarantine protocols, are essential to minimise the risk of infectious diseases and improve productivity.

**Breeding and reproduction management:** Strategic breeding programmes can enhance productivity. This involves selecting high-quality breeding stock, considering genetic traits, managing breeding cycles, and practicing appropriate mating methods.

**Management practices:** Effective and efficient management practices, including proper record-keeping, regular monitoring of weight and growth, and timely interventions for health concerns, can help maximise production. A well-implemented management plan ensures optimal performance and productivity.

**Market demand and prices:** The demand for goat products, such as meat, milk, and fiber, affects the profitability of goat production. Understanding market trends, pricing, and consumer preferences can help guide production decisions, including breed selection and production goals.

**Economics:** Investment in infrastructure, equipment, and inputs, as well as labor costs, are important factors to consider when evaluating the profitability of goat farming. Understanding the economics of goat production is crucial for successful and sustainable operations.

**Farming system:** Different types of farming systems can have a significant impact on the production of goats. Different farming systems vary in terms of their management practices, infrastructure, availability of resources, and level of intensification. Here are some brief explanations of how different types of farming systems can affect goat production:

- **Extensive Farming:** In extensive farming systems, goats are raised on large grazing areas with minimal human intervention. They rely mostly on natural forage resources. While this system allows goats to exhibit their natural behaviour and reduces production costs, it may result in lower productivity due to limited control over forage quality and availability. Goats in extensive systems may face greater exposure to predators and diseases as well.

- **Semi-Intensive Farming:** In semi-intensive systems, goats have access to grazing areas as well as additional supplementary feed and shelter. This system allows for some control over nutrition and health management, which can positively influence goat production. However, the level of productivity may still be lower compared to intensive systems because there is some reliance on natural forage.

- **Intensive Farming:** Intensive farming systems involve keeping goats in confinement or small areas and providing them with controlled feeding, housing, and healthcare facilities. This system offers the highest level of management and productivity. The ability to control nutrition, breeding, and disease prevention leads to, milk production, and.

In a nutshell, the consideration of these factors and implementation of appropriate management practices, the production of goats can be optimized for various purposes, including higher growth rates, meat, milk, fiber, and reproductive efficiency and breeding goats.

The author is a livestock production and nutrition student at the University of Zimbabwe.
A comprehensive guide to crop monitoring systems:

The real magic of crop monitoring systems lies in artificial intelligence. AI algorithms process the vast amounts of data collected from satellites and sensors. Machine learning techniques analyse this data, identifying patterns, trends, and potential issues. AI algorithms can predict crop yields, detect diseases before they are visible to the human eye, and offer tailored recommendations for optimal farming practices. The ability to process complex data swiftly and accurately makes AI a cornerstone of modern crop monitoring systems.

The Impact on Agriculture: Empowering Farmers and Ensuring Food Security

i) Precision Agriculture: Farming with Pinpoint Accuracy
Crop monitoring systems pave the way for precision agriculture, a practice where every action is data-driven and tailored to specific field conditions. Farmers can precisely calibrate irrigation systems, ensuring each plant receives the right amount of water. Similarly, fertilisation and pesticide application are optimised based on real-time data. Precision agriculture not only maximises yields but also minimises resource waste, making farming more sustainable.

ii) Early Detection of Issues: Mitigating Crop Losses
One of the significant advantages of crop monitoring systems is their ability to detect issues at their nascent stage. Diseases, pests, or nutrient deficiencies are identified early, enabling farmers to take immediate corrective measures. Early detection minimises crop losses, reducing the reliance on chemical interventions, and promotes organic farming practices. This proactive approach enhances crop resilience, ensuring consistent yields even in the face of challenges.

iii) Sustainable Agriculture: Balancing Productivity and Ecology
Sustainability is at the core of modern agriculture. Crop monitoring systems play a pivotal role in achieving this balance between productivity and ecological preservation. By optimising resource usage, minimising waste, and promoting eco-friendly practices, these systems contribute to sustainable farming. Farmers are not just guardians of their fields; they are stewards of the environment, ensuring that future generations inherit fertile lands and thriving ecosystems.

Challenges and Future Trends:

Navigating the Path Ahead
While crop monitoring systems have transformed agriculture, they are not without challenges. Issues related to data privacy, the digital divide in rural areas, and the need for continuous technological updates pose hurdles. Addressing these challenges requires collaborative efforts between governments, tech companies, and farmers’ associations. Moreover, the future holds promising developments, such as the integration of drones for aerial monitoring, advancements in AI algorithms for even more precise predictions, and the democratisation of technology to reach even the smallest farms.

Conclusion: Cultivating a Sustainable Future
In the grand tapestry of agriculture, crop monitoring systems stand as vibrant threads, weaving together tradition and technology. They represent a harmonious blend of ancient wisdom and cutting-edge innovation. As we embrace these systems, we embark on a journey toward a future where every acre of land is cultivated sustainably, every crop is nurtured meticulously, and every farmer is empowered with knowledge.

The comprehensive guide to crop monitoring systems is not just a manual; it is a testament to the resilience of agriculture and the ingenuity of human creativity. In its pages, farmers find not just data, but hope — hope for abundant harvests, prosperous livelihoods, and a greener, more sustainable planet. Together, with the aid of crop monitoring systems, we sow the seeds of a better tomorrow, one field at a time.

Supplied by Bluefin Technology. Email: info@bluefin-technology.co.zw or visit www.bluefin-technology.co.zw
After toiling through the crop production process, the last thing a farmer wants is to experience harvest and post-harvest losses. Sadly, these losses account for up to 30 percent of the losses a farmer can experience in Zimbabwe, which has a bearing on the profitability of farming activities.

Maturity and harvesting stages are one of the most important stages in the production of any crop. Wheat includes, as they signal the end of the production cycle. It is critical for farmers to know that the two stages are different with physiological maturity coming before harvesting. It is critical for a farmer to know when his/her crop has reached physiological maturity because that is when most of the field practices such as fertiliser application and irrigation must stop. However, some farmers may come in with pre-harvest weed control, which needs careful consideration because of the costs, as well as pre-harvest interval (PHI) requirement especially for the milling industry. Physiological maturity is when a crop has accumulated the maximum amount of dry matter in the developing kernel and what is left is to dry down to the moisture level required for storage so that harvesting can start. It is important for the farmer to be sure that his/her crop has reached maturity before stopping irrigation. How then can we then know that the wheat crop has reached maturity? Moisture level may not be a very good indicator for maturity because a crop may have dried prematurely before reaching physiological maturity. However, there are other indices, which include:

1. When the green colour has disappeared from the upper node of the stem (PEDUNCLE)
2. A pigment strand appears along the crease of the kernel, similar to the black layer of maize. To check for the pigment there is need to cut the kernel and assess it. It is important to note that not all kernels in a spike or all spikelets mature at the same time. Irrigation is stopped when at least 90 percent have reached maturity.

After the crop reaches physiological maturity, it must be allowed to dry down before harvesting commences. The pre-harvesting and harvesting period is very critical and requires articulate planning and proper timing especially considering that wheat is harvested towards the beginning of the rainy season. Leaving it in the field poses the risk of it being caught by the rains, which affects quality.

It is equally important to harvest at the right stage to minimise losses. Harvesting too early may lead to the grain rotting and hence affects quality while harvesting too late means the grain over dries leading to weight loss and hence tonnage loss too. Harvesting indicators include when the pikelets have turned yellow and moisture is between 12 and 15 percent. A farmer can harvest her crop at 18 percent grain moisture if she has driers or access to driers. It is easier to check the moisture using the moisture metre if it is available, however, in the absence of a moisture metre the farmer can tell if wheat is almost at harvesting stage when almost 90 percent of the crop is dry and has turned golden colour.

Sometimes the wheat may take long to dry and a farmer can be tempted to stop irrigation so as to speed up drying. Don’t do this. Some farmers come in with chemicals such as glyphosate and ‘paraquat.’ This is not encouraged as it may have negative effects to the consumers and the product may not pass the quality test.

Particular attention must be paid to the crop at this time yet most farmer do not do so, as they will be feeling that they would have completed their task. The aim is to ensure as little grain as possible is lost. The first step when harvesting using a combine harvester is to ensure that the settings are correct because that is one of the loss points. The aim is to get the most wheat grain with the least amount of straw. The operator must:

- Ensure that about 20-30cm of straw remains
- Adjust the head as the height during harvesting according to the different height of wheat in different parts of the field.
- If more straw is being taken, adjust the head by increasing its height
- Ensure that there is someone checking behind the combine to ensure that you are not losing grain. If grain is being lost, the combine may be moving too slowly, adjust the speed.
- Once in a while, check the combine bin and check the grain. Broken grain is downgraded at the point of sale and we need to reduce the percentage of broken grain as much as possible. The acceptable percentage is 3 percent by the Grain Marketing Board (GMB) standards. If out of 100 grains you get more than 3 broken pieces, the operator must adjust the rotor or cylinder.

Storing the grain must also be prepared for carefully. Ensure good ventilation so that there is enough aeration. If the wheat is not dry enough and the temperatures are high, the wheat will germinate and will not meet the premium grade.

It is also critical for a farmer to know the grades and what makes the wheat grading standards so that he/she grades the wheat before sending it to market. It is always important to grade wheat so that it is paid accordingly. If wheat is of mixed grades it will be paid the price of the minimum grade and the farmer will lose on premium. Below is the table showing GMB standards for wheat:

*(Defective includes discoloured, diseased, insect damaged, unthreshed, undeveloped wheat)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Grade</th>
<th>Premium</th>
<th>Standard</th>
<th>Utility 1</th>
<th>Utility 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein content (max%)</td>
<td>12.5</td>
<td>12.5</td>
<td>12.5</td>
<td>12.5</td>
<td>12.5</td>
</tr>
<tr>
<td>Moisture Content (max%)</td>
<td>11</td>
<td>9</td>
<td>8</td>
<td>8</td>
<td>8</td>
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<tr>
<td>Test density (min kg/hl)</td>
<td>230</td>
<td>230</td>
<td>220</td>
<td>210</td>
<td>200</td>
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<tr>
<td>Extraneous matter (max%)</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Broken grain (max%)</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
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</tr>
<tr>
<td>Grit (max%)</td>
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<tr>
<td>*Defective (max%)</td>
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<td>4</td>
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<td>Geminated wheat (max%)</td>
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<td>3</td>
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<tr>
<td>Protein content (max%)</td>
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<tr>
<td>Falling number (sec.min)</td>
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<td>230</td>
<td>220</td>
<td>210</td>
<td>200</td>
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</table>

Source: GMB website
“Manure is an organic matter derived from the solid animal wastes, used to improve the soil quality and increase the yield of healthy crops.”

What is Manure?
Manure is the decomposed form of dead plants and animals, which is applied to the soil to increase production. It is a natural form of fertiliser and is cost-effective. The human and animal excreta is also used as manure. The livestock manure is rich in nitrogen, phosphorus, and potassium.

Manure is highly rich in organic matter and humus and thus improves the soil fertility. These are better in the long run and do not cause any pollution. It is a valuable and renewable resource.

Manure can be obtained from various sources. The different sources of manure are mentioned below:

- Cattle dung, urine, and slurry from biogas plants.
- Wastes from human habitation such as human urine, night soil, sludge, sewage, domestic waste.
- Droppings of goat and sheep
- Waste from the slaughterhouses such as bones, meat, horn and hoof meal, fish waste
- By-products of agricultural industries
- Crop waste
- Weeds, water hyacinth

Also Read: Crop production and management

Types of Manure
Manure can be grouped as farmyard manure, green manure and compost manure. Following are the different types of manure used by the farmers:

Green Manure
Green manure increases the percentage of organic matter in the soil. The roots of such manures go deep into the soil. These help in the suppression of weeds and the prevention of soil erosion.

Farmyard Manure
Farmyard manure improves the soil structure and is used as a natural fertiliser in farming. It increases the soil capacity to hold more water and nutrients. It also increases the microbial activity of the soil to improve its mineral supply and also the plant nutrients.

Compost Manure
It improves the soil structure and water and nutrient holding capacity of the soil. Thus, it increases the nutrient value and thereby improves the health of the plants.

Advantages of Manure
- These are a good source of macronutrients.
- Improves soil fertility.
- Cost-effective
- Reduces soil erosion and leaching
- Improves the physical properties of the soil and aerates the soil.
- It can be transported easily.
- Methane gas is evolved as the by-product of manure that can be used for cooking and heating purposes.
- The crops grown on the land treated with manure produces healthy crops.

Manure is an ideal soil amendment. When it is applied to the agricultural fields it acts as a field residue. Farmers can sell the manure to people who need to improve their soil fertility. Thus, it can bring income to farmers. They add to the overall soil ability and sustainability.

Manure increases the water holding capacity of the soil. The organic content of the soil can also be improved by applying raw manure like biochar, compost and many others.

Different types of manure contain about 26 percent solid. The solid and liquid portions are segregated and the solids are used for bedding. The carbon content and other elements can be used to produce different biofuels.

Manure also contains a large number of fibres. The undigested animal feed, straw, sawdust, other bedding contains a lot of fibre.

Manure is environment-friendly and has contributed a great deal in increasing food production. It was very difficult to feed a growing population. Use of manure improved the fertility of the soil and increased the yield of the crops.

To know more about what is manure, its types and advantages, keep visiting BYJU’S website or download BYJU’S app for further reference.
Pfumvudza/Intwasa and the smallholder farmer

Rutendo Nhongonhema

PFUMVUDZA is a conservation agriculture technology adopted by Government with the aim of addressing low productivity among the smallholder farmers, which has led to food insecurity and poverty. The low productivity is caused chiefly by climate change, which has resulted in poor rainfall, intense heat and long mid-season dry spells. Sometimes this is punctuated by flash floods that wash away the established crop. Apart from climate change induced challenges, poor yields are also caused by farmers not adhering to good agronomic practices mainly due to extenuation (planting large fields with very little resources). Pfumvudza/Intwasa aims to solve the above challenges through:

1. Moisture Conservation

Mulching is one key principle of Pfumvudza/Intwasa that is important for maintaining moisture levels. Mulch conserves moisture in the soil through reducing evapotranspiration, smothering or at least suppressing existing weeds and reducing and increasing percolation and retention. More specifically, it can reduce the loss of water by surface evaporation by 70 percent. The effectiveness of mulch depends on the density and texture of the material used and the depth of the layer applied. A 5-10cm layer of most materials is considered effective and prevents weed growth. Some literature talks of 30 percent cover by mulch.

1. Precision planting and fertiliser management

‘You can only harvest what you have sowed’ is an important statement to be considered especially by smallholder farmers. One of the reasons for poor yields among smallholder farmers is the small plot size of 0.05ha. The soil layers under mulch is able to remain moist for longer periods even during dry spells and facilitates the uptake of nutrients resulting in enhanced growth processes. Most crops thrive are between pH 5.5 and pH 7. Ideally, liming must be done every three years, however, due to the fact that most soils have not been limed for long and are therefore too acidic, it is recommended to apply moderate amounts of lime (approximately 600kg/ha) every year till the pH is corrected. Ideally, lime must be applied at least 3 months before planting to give it time to ameliorate the soil. For lime to work, the soil must be moist; liquid lime may need shorter time to ameliorate the soil.

1. Good crop management

Precise nutrient management is one of the pluses for Pfumvudza/Intwasa. Application of 5g basal fertiliser and 300g manure per planting station ensures that all plants have access to nutrients. Top dressing is split applied (5g) to crops at 3 weeks and another 5g at flowering. This reduces time and labour required to pull out weeds as well as competition with crops for nutrients and water.

Optimum plant population also ensures an early canopy that smothers weeds. Improvement in moisture around the plant roots is one of the biggest wins in Pfumvudza/Intwasa. The moisture in the inner layers of the un-ploughed soil is not exposed to evaporation. Mulching increases infiltration of water into the soil as well as reducing evaporation of moisture from the covered soil surface.

The soil layers under mulch is able to remain moist for longer periods even during dry spells and facilitates the uptake of nutrients resulting in enhanced growth processes. Limeing should always be informed by soil tests. The Wadax base soil pH map of Zimbabwe shows that most of the country has very low pH (dangerously low).

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1. Improved sustainability of farming

From time immemorial, soil has been known to be the best inheritance to give future generations. This can only happen if the current generation are good custodians of the lands. Continuous turning of the soil exposes it to soil erosion which washes away top soil (the most fertile soils is found within the top 5cm of the soil profile). The basic principle of Pfumvudza/Intwasa is minimum soil disturbance.

This means that only soil where planting is to be done is turned and hence reduced erosion. Ploughing the soil breaks up soil aggregates, hence speeding up the breakdown of organic matter making the soil less fertile.

Increased water infiltration and improvement in soil structure is also achieved when farmers use the same planting station for years hence giving the unploughed part time to rejuvenate and organic matter to decompose and increase infiltration. Raindrop impact is reduced on mulched and hence reduced in soil erosion.

5. Commercialisation of the smallholder farming sector

Under Pfumvudza/Intwasa, the Government supports establishment of 3 cereal plots (one for family consumption, one for sale to get income and the other one for storage in case of bad season). This means that smallholder farmers can actually get an income from their small plots. On the other hand, research has shown that Conservation farming has lower costs than conventional farming especially through tillage saving and labour savings.

Nhongonhema is a chief agronomist with Ministry of Lands, Agriculture, Fisheries, Water and Rural Development.
The World Health Organisation (WHO) in 2007 estimated that 1,800,000 people die each year from diarrheal diseases, and most cases can be attributed to contaminated food or drinking water. Every day in every country, people fall ill from the food they have eaten. Dangerous microorganisms and/or toxic chemicals cause these foodborne illnesses. Even though governments throughout the world do their utmost to improve the safety and quality of food, the high number of foodborne illnesses is a major public health issue for all countries.

Food Protection is an over-arching concept that includes the four pillars of the food system, Food Quality, Food Safety, Food Fraud, and Food Defence. Successful implementation of programmes across this continuum will also contribute to food security. Food safety is conceived as an ‘organised system’ with the aim of meeting a regulatory objective (producing safe and suitable food) and, if relevant, other contractual objectives (complying with one or more private certification schemes). The industry refers to this as a Food Safety Management System (FSMS).

In order to meet food quality and safety requirements, agricultural businesses must identify all aspects of their activities that are necessary for the safety of their products. They must be able to control all hazards at all stages of product life cycle (development, production, storage, transport, and retail sale). Consumers must also recognise that they are responsible for the proper storage, handling and cooking of food. Feed manufacturers, farmers, and food operators have the primary responsibility for food safety. It is up to each actor in the food production and distribution chain to take all steps to make sure that products placed on the market are free of all risks to consumers’ health. Many of the hazards attributed to food originate in the failure to respect hygiene rules at the place of production. This can be in the field or on the packaging line, or during storage or transport. For this reason, general rules of hygiene applicable to the food industry are also valid for primary production.

As a large portion of fruit and vegetables are eaten raw, hygiene is an essential requirement for the conformity of these products. Simple or cross-contamination of fruit and vegetables, either before or after harvest, can have several causes. Growing areas, soil, inputs (manure), equipment, and staff are all potential pathogen vectors. Each producer or firm should organise hygiene measures and practices that are adapted to the specific conditions of their production area, type of products, methods and techniques, and staff in order to monitor and control risks to food safety and promote the production of wholesome fruit and vegetables.

The EU, UK among others imports processed products or fresh produce certified to GFSI recognised food safety certification schemes. Furthermore, demand for local fresh produce and processed products has expanded to the mid-east to countries such as China, UAE, Qatar among others. Compliance to food safety certification schemes will unlock access to these global markets for local companies.

Obert Chifamba

Afra on cusp of living her dream at Arden Farm

She is the prime example of a multipotentialite. A ‘Jack of all trades.’ A humanitarian with a soft spot for children, youths and fellow women. Afra Nhanhanga is the epitome of talent and hard work driven by a never-say-die spirit. And above all — a farmer par excellence!

Born 48 years ago in Samuzaoda Village in Mutasa district of Manicaland province, Afra is the first child in a family of six. Her parents led a very simple life in which the father was a mechanic working for then prominent bus operator, Ben Mucheche while the mother was an enterprising housewife who built her reputation around various agricultural projects anchored by horticultural crops.

“My mother was very enterprising and would grow crops like tomatoes, leafy vegetables, potatoes and cereals like maize. Our house in the village was built using proceeds from a tomato project, which was something that motivated me to be hard working and to set myself targets from an early age,” the soft-spoken Afra told this news crew on a recent visit to her vast Arden Farm in Buffalo Downs just outside the town of Karoi.

And because both her enterprising parents were always busy vending for the family, Afra would, as the eldest take care of her siblings with an ailing young sister among them, which she confesses helped her develop a sense of responsibility and care for the next person.

“My rural life shaped me into what I am today. We were brought up to have compassion for the next person, respect for every person and above all, a sense of ownership for everything that involved family. Each August school holiday I would visit Harare where my father was staying and I would ferry berries and maize for sale in Highfield’s Lusaka and Egypt sections. This would keep me busy while at the same time nurturing an interest in business inside me,” narrated Afra.

Her father had a pick-up truck that used to be hired by women going to buy fresh produce from Mbare and Lusaka fresh produce markets. Afra would accompany her father on all his trips to the markets and would collect the transport charges from the women. Afra admits that this was the point at which she realised that there was a lot of money in agriculture with everything about her life seeming to be anchored on revenue generated from farming.

She confesses that she never dreamt she would one day become the successful philanthropist, businesswoman and farmer that she is today coming from such a humble background that at one stage saw her working as a conductor on buses plying almost all of the key routes between managing her farming projects and her managerial position at the company that speaks volumes of commitment to both projects.

“The farmer in me refused to die even after I had settled well into the transport industry and in 2005 I got this farm under the land reform programme. It is unfortunate that I have not been able to make meaningful investments on the farm because of a dispute with a neighbour who claims the farm belongs to him. That dispute has not been resolved up to the present but I have since resolved to push that aside and start utilising the land. I produce wheat, maize, cattle and other small livestock units.

“At the moment I am seized with developing my fish project in these 21 ponds that you see. Some of them do not have fish yet but am on course to stock them. Fish farming is a project that is not labour intensive and once you establish the ponds,” she said.

Good things naturally come to those who do good unto others. Afra’s fish project has since courted the attention of Chinhoyi University of Technology (CUT) in a development that looks set to end one of her biggest challenges – shortages of feed.

“We will be doing research trials on for-farm feed formulations using the black soldier flies. We will introduce at least 44 000 fingerlings into 16 ponds and see how the feeds perform. The programme is funded by the Food and Agriculture Organisation (FAO) and once we have a breakthrough, that will mean fish farmers will not continue to face the feed shortages they are facing. We will be producing at a larger scale and even train other people to do it as well,” Dean of the School of Wildlife and Environmental Sciences at CUT, Professor Taurai Bere explained recently.

Essentially, the research’s success will help improve access to feeds, which feeds into Afra’s plans to start training other farmers on fish farming. It will also relieve her of the burden of importing feeds from neighbouring Zambia, which is ballooning her costs of production. The development will encourage many farmers to take up fish farming and boost production of the product that is always in short supply country-wide.

“There is abundant market for fish at the moment. I am encouraging youths and women to try it out and see how it goes. They will never be stuck with the product, as there are consumers waiting to take it up,” said Afra.

Afra’s farming activities have not only helped her but a host of other Zimbabweans with whom life is not easy. This has since earned her recognition both locally and globally and now sits on several humanitarian boards.

At a personal level, she takes care of many underprivileged children with her philanthropy work taking her to places like Karoi Prison in Mashonaland West province. For these exploits, Afra has won awards like the United Nations Global Leadership Award, Outstanding Global Peace Ambassador for Change, Megafest 2022 Outstanding Business Woman of the Year Award, Outstanding Woman Chief Executive Officer of the Year Gold Award at the Megafest Women Leadership awards, 50 Visionary and Inspiration Women Award.

The University of South Africa (UNISA) also bestowed her with an honorary entrepreneurship degree in a move demonstrating how her works have had far-reaching implications on humanity. America’s Trinity University of Embassadors has also bestowed her with a doctor of philosophy degree for her contribution to Zimbabwe’s business sector. She is now Dr Afra Nhanhanga, thanks to her various exploits on and off the field of agriculture. She is more comfortable being called Afra, though, she says jokingly.

“A mother of four — three girls and one boy — Afra is married to Edson Chinhambu who has also been very helpful in growing the CAG Tours empire and her farming projects.
Managing fungal diseases in crops during the rainy season

Fungi constitute the largest number of plant pathogens and are responsible for a range of serious plant diseases. Most vegetable diseases are caused by fungi. They damage plants by killing cells and or causing plant stress.

Sources of fungal infections are infected seed, soil, crop debris, nearby crops and weeds. Fungi are spread by wind and water splash, and through the movement of contaminated soil, animals, workers, machinery, tools, seedlings and other plant material. They enter plants through natural openings such as stomata and through wounds caused by pruning, harvesting, hail, insects, other diseases, and mechanical damage.

Some of the fungi are responsible for foliar diseases – Downy mildews; Powdery mildews and White blisters are some of the highly prevalent foliar diseases.

Other fungi — Clubroot, Pythium species; Fusarium species; Rhizoctonia species; Sclerotinia and Sclerotium species are soil borne diseases. Some fungal diseases occur on a wide range of vegetables. These diseases include Early Blight, Late Blight, Anthracnose Botrytis rot, Downy mildews, Fusarium rot, Powdery mildews; Rusts.

The rainy season is a difficult time to control fungal diseases in open field crops. Rains bring moisture and humidity in between them and periods of sunshine. These jointly contribute to the creation of an environment suitable for most fungal infections. Farmers, especially those growing horticultural crops, must stay alert during the rainy season. It is advisable to apply a fungicide after every major rainfall incident for crops like tomatoes, potatoes, melons and many others.

Examples of the most common fungal diseases:

- Powdery mildew: White, powdery growth on leaves, new shoots and other plant parts. Often signal powdery mildew has arrived.
- Unlikely many fungal diseases, powdery mildew does not need free water to develop and spread; it stays active even in dry, warm weather. High humidity and poor air circulation encourage this wind-borne disease, which targets succulent new growth.

**Late Blight:** Phytophthora infestans is the oomycete, or water mould pathogen, responsible for tomato late blight. This fungus-like organism overwinters primarily in plant debris as mycelia, a filamentous thread-like growth of the pathogen. Late blight is a potentially devastating disease of tomato and potato, infecting leaves, stems, tomato fruit, and potato tubers. The disease spreads quickly in fields and can result in total crop failure if untreated. Late blight of potato was responsible for the Irish potato famine of the late 1840s. Under cool, wet conditions, P. Infestans can infect and produce thousands of sporangia per lesion in less than five days. These sporangia easily become airborne, resulting in prolific spread of the pathogen.

**Early blight:** Can be caused by two closely related species: Alternaria solani and Alternaria solani. Both pathogens can infect tomatoes, potato, peppers, and several weeds in the Solanaceae family. The pathogen is most likely to spread with any weather or heavy dew, or when relative humidity is 90 per cent or greater. Lower leaves become infected when they come into contact with contaminated soil, either through direct contact or when raindrops splash soil onto the leaves. Spores can be spread throughout a field by wind, human contact or equipment, resulting in many reinfection opportunities throughout a growing season.

**Management:** Integrated Crop Protection (ICP) or the Integrated Pest Management (IPM) approach has achieved success in the management of the fungal diseases. ICP considers the production system as a whole, including all pests and the importance of soil health. It requires a good understanding of the fungi; the periods during which the crops are susceptible; and the influence of environmental conditions.

**Tips for managing fungal diseases include:**

- Understand the lifecycles, survival mechanisms, and conducive environmental conditions for fungi
- Be committed to farm sanitation — clean up your farm and remove all weeds, crop debris, and volunteer hosts
- Use resistant or tolerant varieties

**Clubroot**

- Use clean transplants and seed (and seed treatments)
- Monitor weather conditions (particularly temperature, humidity, and leaf wetness)
- Have knowledge of relevant disease prediction models
- Understand the implications for irrigation timing and minimise free moisture and high humidity periods (for example, irrigating at around 4 am rather than at dusk, not irrigating during peak periods of spore release)
- Appropriate crop rotations (long rotations with non-host crops may be necessary)
- Avoid heavily infested blocks by testing soil for soil borne diseases prior to planting
- Monitor crops regularly and be able to detect early symptoms on your crop
- Amend and manage soil to disadvantage the fungi (some fungal diseases can survive in the soil for 30 years or more)
- Minimise ways through which the disease can spread on-farm — remove and destroy sick plants when symptoms first show

**Pythium species**

- Use clean transplants and seed (and seed treatments)
- Monitor weather conditions (particularly temperature, humidity, and leaf wetness)
- Have knowledge of relevant disease prediction models
- Understand the implications for irrigation timing and minimise free moisture and high humidity periods (for example, irrigating at around 4 am rather than at dusk, not irrigating during peak periods of spore release)
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**Rhizoctonia species**

- Use clean transplants and seed (and seed treatments)
- Monitor weather conditions (particularly temperature, humidity, and leaf wetness)
- Have knowledge of relevant disease prediction models
- Understand the implications for irrigation timing and minimise free moisture and high humidity periods (for example, irrigating at around 4 am rather than at dusk, not irrigating during peak periods of spore release)
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**Simple ways of marketing your agricultural produce**

1. Farmers’ Markets: Participate in local farmers’ markets such as Mbare Musika in Harare or Bulawayo Farmers’ Market. Set up an attractive booth showcasing your fresh produce and engage with customers directly.
2. Contract Farming: Enter into contracts with agribusinesses like Olivine Industries, which processes cooking oil and other food products. They can provide inputs, technical support, and a guaranteed market for your agricultural products.
3. Direct Sales to Retailers: Approach local grocery stores and supermarkets, such as OK Zimbabwe or Spar, to sell your agricultural products directly to them. Build relationships with store managers and ensure a consistent supply of quality products.
4. Community Supported Agriculture (CSAs): Start a CSA programme where consumers in your community subscribe to receive regular deliveries of your fresh produce. Promote it through local community groups, social media, or flyers in neighbourhood shops.
5. Online Platforms: Utilise online platforms like Kudobuzz or Fresh in a Box to sell and market your agricultural products. Create an online store where customers can browse your offerings and place orders for delivery.
6. Mobile Applications: Utilise mobile applications, which connect farmers directly with consumers. List your products on the app and promote your farm and offerings to potential buyers.
7. Value-Added Products: Process surplus produce into value-added products like sun-dried fruits or homemade jam. Package them attractively and sell them through local stores, farmers’ markets, or online platforms like classifieds.co.zw.
8. Farm-to-Restaurant Programmes: Collaborate with local restaurants to supply them with fresh produce. Work with chefs who value locally sourced ingredients and establish a direct farm-to-table connection.
9. Export Opportunities: Explore export opportunities for specific crops or products that have demand internationally, for example, partner with exporters to access international markets for products like macadamia nuts or avocados.
10. Agro-Tourism: Develop agro-tourism activities on your farm, such as farm tours or farm-stay accommodations. For instance, offer guided tours of your vegetable farm or provide lodging for tourists interested in experiencing rural life and purchasing your products.
11. Farm Stands: Set up farm stands or roadside stalls near high-traffic areas to sell products directly to consumers.
12. Collaborative Marketing: Join forces with other farmers to collectively market and promote your agricultural products, pooling resources and expanding your reach.

Adapted from the Internet
**Honey production**

It has been promoted in many countries as a major rural development engine. Not only does the practice of beekeeping have intrinsic health benefits through providing a food source of great nutritional value; but it also does not require much inputs and capitalises on a readily available supply of pollen and nectar from the crops they pollinate.

Beeskeeping is therefore, emerging as a very successful agricultural practice for the country’s rural and urban areas mainly due to the huge economic benefits generated from its products, for example, in Zimbabwe honey, beeswax, propolis, royal jelly and bee venom are major financial products while pollination is the major biodiversity benefit. Bee farmers in Zimbabwe have continued to practise traditional methods of beekeeping despite the introduction of modern beekeeping methods hence the need for trainings to educate the farmers on the advantages of shifting to modern bee farming practices. Modern hives will also, by the nature of their management, be beneficial to local communities by conserving the environment around them.

**Basic Requirements**

1. **Forage** — these are flowering plants of different types and varieties that provide bees with nectar and/or pollen almost all year round. These includes Eucalyptus spp, Jacaranda spp, Acacia spp, Luceana spp, weaving willow, fruit trees, ordinary flowers and many others.
2. **Water** — as well as forage should be made available within a three-kilometre radius. Water maybe made available in troughs, containers, old tyres and so forth. Never provide water in containers, as bees may drown.
3. **Bee hives** — standard bee hives are recommended. Hives are supposed to be constructed from dry soft wood timber from trees like pines or cyprus. For commercial bee farming, in Zimbabwe we recommend the use of Kenyan Top Bar Hive (KTBH) and the Langstroth frame hive with an average production of 15kg and 30kg of comb honey (unprocessed) respectively.
4. **Attractants** — for easy colonisation of hives, one should apply attractants inside and outside at the entrance only to lure bees. Propolis (namo), beeswax, lemon grass, banana peels may be used as attractants to lure bees. Never use sugar syrup or honey in luring bees as these may also lure ants. Some hives are occupied during a week with others taking even as much as three months. Catch boxes (smaller hives) may be used in catching swarms, which are later transferred into main hives.
5. **Production and Processing Equipment** — a complete bee suit with preferably leather gloves, smoker, hive tool, hive knife, bee brush and honey containers, honey pressers, honey extractors and packaging material is needed.

**Introduction**

It is still a challenge to improve the living standards of rural people through modern beekeeping methods despite the vast technological advancement the country has gone through. Beekeeping enterprises among other initiatives in agriculture had not been receiving sufficient attention in the past, as is now happening.

**Production**

Some of the honey sold even in reputable shops and pharmacies is adulterated or fake. Around 85 000 tonnes of natural pure liquid honey is cropped annually in Zimbabwe with 60 percent of it coming from traditional hives.

**Farmer Gender distribution**

On average, there are 85 percent or more men in this industry simply because of people’s perceptions on beekeeping.

**Basic Requirements**

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**Apairy Siting**

A apiary refers to a place where bees are kept and one should consider the following factors for proper siting of the apiary:

1. At least 50m away from a homestead
2. At least 50m away from a busy road (with some literature even suggesting more)
3. Provided with proper shed
4. Within a three-kilometre radius of forage and water
5. With minimum interference form other farming enterprises hence marginal areas/lands are ideal.
6. Give proper security from stray animals by fencing it.

**Hive mounting**

For easy management, hives are supposed to be mounted on stands of workable height and not on trees. Spacing also to be of a workable distance as well as be mounted so that it is easy to access the combs. Some may go up to four times a year but in Zimbabwe, its twice a year (April/May) and (October/November).

**Cropping/ Harvesting**

The number of cropping frequencies mainly depends on the abundance of forage (flowering plants) and the size of the colony. Some may go even up to four times a year but in Zimbabwe, its twice a year (April/May) and (October/November). Only mature capped honey (Fig 5) should be harvested as immature honey causes stomach problems when consumed. For honey processing we use a honey presser top bar hive and an extractor for frame hives. (Fig 6 and 7)

**Packaging and Storage**

Properly packaged mature honey can stay for several hundreds of years without going bad. Some use glass and plastic bottles as containers with glass bottles being the best as they have minimum chances of reacting with honey inside them. Farmers should not worry when their honey appears solid like margarine during cold weather, as this is just crystallisation, which is another sign that your honey is not fake!
Feeding goats

Goats are easy to keep and are very profitable as the feed costs are low due to the fact that they eat a variety of foods.

Adequate energy is also important for good conception rates, milk production and kid growth rates, high-energy supplements include: Maize, rice or wheat bran.

Goat meal or goat pellets from feed manufacturers.

Given the financial limitations that most smallholder farmers experience, goat producers should be advised and encouraged to grow a variety and store large quantities of byproducts to supplement their goats during the dry season and reduce the amount of purchased commercial feeds.

Mineral salts
- Goats need mineral salts, mainly calcium and phosphorus, for bone growth and development. For reproduction and lactation, for promoting appetite, immunity and weight gain and to improve the hair coat appearance.

Feeds provide some of mineral requirements but where these are inadequate to meet the animal’s requirements, supplementary minerals in the form of commercial mineral mixtures should be provided.

Water needs and water management
The amount of water needed by a goat varies with the breed, climate, the type of feed taken and the physiological condition of animal (for example, whether pregnant or lactating).

A few tips
- Goats consume 4 times as much water as dry matter for dairy goats, provide 1, 3 litres of water per litre of milk produced.
- Provide clean water at all times.
- Feeding and water troughs:
  - An ideal water and feed trough should be made of material that is easy to clean (for example, cement or plastic) according to the means of the farmer.
  - The depth should be low enough (about 30 cm deep) to allow even the kids to drink from it.
  - It should not be too low to allow goats, especially kids to stand in the trough and pollute the water.
  - Allow a space of 45 cm per goat.

Experts insights on optimising apiary placement for bee health and production

Honey is a delicious and nutritious food. It may be consumed alone or as an ingredient in the preparation of many foods. Bees collect nectar and pollen from flowers to make honey. The nectar is filtered and stored in honeycombs. The bees add a high protein content and are part of the diet in many societies. Royal jelly and pollen are consumed for their high protein value.

A good apiary placement starts with choosing a good site to hang or place hives. If you choose a site that is not secured, people and animals may be stung and honey and hives can be stolen. The following are recommended practices for a good apiary site:

- The site must be easily accessible by vehicular traffic. Beekeeping should be viewed as a business that has external inputs and will also regularly produce products that need to be taken to markets.
- There must be plenty of flowering plants within a three-kilometre radius of the location of the apiary. The main raw materials for honey are nectar, which comes from flowers. There must be plenty of gardens and orchards around the site. Alternatively, the site may be in a part of the forest with plenty of flowering trees.
- Ideally, the apiary should be located far from residential and other public areas to avoid bees stinging people.

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A drought happens when a region receives less than average rainfall. Unlike the simplicity of this definition, the actual scenario is devastating.

Droughts don’t just affect the plants or livestock of a region, but they also pose a great threat to human lives. It is regarded as a natural disaster considering the damage it does to the entire ecosystem.

We have seen examples of how droughts can create great economic instabilities, owing to the lowered production of resources. In the past 40 years, no natural disaster has affected more people than droughts.

Climate change has been a major factor in the creation of droughts in several parts of the world. As the earth is heating up, many regions of the world are experiencing less precipitation and droughts are becoming more common than ever before.

However, we humans have the ability to think and use our skills to engineer solutions, and in this article, we will go through some of these methods.

1. Desalination of water

Source: ANDREJ NEUHERZ/Wikimedia Commons

Even though more than 70 percent of the earth’s surface is covered with water, only 0.003 percent of it is fresh water. In many places of the world, annual rainfall is the only way to replenish the freshwater sources.

But what if we could desalinate water? Then we have oceans to help us get fresh water.

But it is easier said than done. Desalination of water is pretty resource intensive. First, the water needs to be boiled, converted to steam and then condensed.

This requires a significant amount of fossil fuels to produce heat. But hope is still at hand as the developments in the field have made filters made up of graphene that can desalinate water with nothing more than hydrostatic pressure.

2. Rainwater harvesting

Source: Adityamail/Wikimedia Commons

Rainwater harvesting has seen major growth in recent years and this is something everyone should adopt. With rainwater harvesting, homes can store the water they get from rain and then use it when they need it in dry conditions.

3. Drip Irrigation

Source: Courtesy of the researchers/MIT

In urban areas, only 15 percent of rainwater enters the ground while in rural areas 50 percent of rainwater is absorbed into the ground. Rainwater harvesting provides both urban and rural areas with an efficient option to store rainwater and then reuse it in times of drought.

We do consume electricity, which in turn, consumes more fossil fuels.

Drip irrigation hopes to achieve optimum water delivery for plants and optimum moisture in the soil. The advantage of such a system is that it does not result in water wastage.

Nowadays, many companies have come forward providing the market with cost-effective and intuitive drip irrigation systems.

Technologically advanced farms are moving towards IoT-inspired drip irrigation systems that can operate without human intervention. The highly targeted nature of drip irrigation ensures that each plant gets the right amount of water delivered right on its roots.

4. Harvesting water from the air

Source: Borishini/Wikimedia Commons

Air as we know it contains many elements, and one among it is moisture. If we could build new mechanisms outside of the plants to keep them watered and safe from drought, but we could also genetically engineer them to be resilient to conditions where the water content in the soil is very low.

Food production is a crucial part of keeping the population alive. However, droughts can affect the productivity and tip the balance of food available to the masses.

Crop engineering hopes to tweak the genetics of existing crops to help them increase their yield and provide them with better resistance to drought.

A research project from Realising Increased Photosynthetic Efficiency (RIPE) has successfully improved crops in the way they use water, up to 25 percent more efficiently.

Researches have been done by various organisations around the world in efforts to engineer crops that can withstand the harshness of droughts.

5. Crop engineering

Source: Picabay

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6. Solar pumps

Source: USDA NRCS Texas/Wikimedia Commons

The most common method that we use to water crops or provide water to livestock is by pumping it out of the earth. However, pumps do consume electricity, which in turn, consumes more fossil fuels.

Solar pumps are gaining popularity because they do not use up electricity from the mains to pump water for irrigation. The governments around the world are realizing the potential of solar pumps and some have even started granting subsidies for farmers to install them cost-effectively.

7. Recycling organic waste

Source: Juan Ortegui/Wikimedia Commons

This is might sound like old-age advice, but planting tree is the best way to reduce damage from drought, improve the quality of the environment and increase the success of precipitation.

Many countries have started their efforts by turning arid lands into forested by planting trees and saplings.

8. Planting more trees

Conclusion

Drought is one of the most damaging natural disasters that we have faced in recent years. By bringing innovative ideas and solutions, we can reduce the effects of droughts as well as put measures in place to prevent the occurrence of this natural disaster altogether.

By: Kashyap Vyas | Interesting Engineering