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AGRICULTURE JOURNAL
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WINTER WHEAT MANAGEMENT


6

Guarding against urea poisoning


12

Maize harvesting methods


13

Business & economics of fish farming

Irrigating wheat

Early vegetative wheat management: Irrigation, fertility management, hardening and weed control

Dior Pote

Introduction

EFFECTIVE early vegetative management is crucial for establishing a healthy wheat crop and maximising yields. In Zimbabwe winter wheat is grown primarily from April to September under irrigation. Proper management of hardening and weed control plays a pivotal role in ensuring robust plant development. Winter wheat in Zimbabwe thrives in regions with distinct altitude zones: Highveld >1200 metres above sea level (masl), Middleveld (900–1250 masl), Lowveld (<900 masl). Optimal daytime temperatures range between 15–20°C, with cooler nights promoting better yields. Wheat crop requires 450–600 mm/ha of water, necessitating irrigation since the country does not experience winter rainfall.

Still Planting

Some farmers are still planting even as closing of the window period draws near. It is important to choose disease-resistant varieties. They are naturally the most preferred varieties when it comes to combating common leaf rust and powdery mildew. Planting of most of this season's wheat crop started end of April although some areas are still planting. Delayed planting beyond May can reduce yields by ~50 kg/ha/day. It is advisable for farmers who are still planting to use a seed rate of 125–140 kg/ha (drilled or broadcast). This should be down with working target of plant density: 250–280 plants/m^2 for optimal tillering and disease resistance. During establishment it is very critical to note that soil profile has to be wet. One has to ensure full soil profile wetting (field capacity to 1.2 m depth) to support germination. Germination usually takes (4–5 days after sowing). After planting one has to apply a light irrigation to break soil crusting and ensure uniform emergence.

Key management practices

What is hardening in wheat?

Wheat hardening is a controlled stress management practice where irrigation is temporarily paused during the early vegetative stage. It usually begins at the 3–4 leaf stage (crown roots start forming) typically 14–21 days after emergence. Did you know that hardening transforms wheat from a "spoiled seedling" into a tough, high-yielding crop by mimicking natural stress — without compromising health. During the process irrigation is withheld to create mild moisture stress. Usually hardening process lasts 10–14 days, depending on soil type (shorter for sandy soils, longer for clay) — 10 days (light soils) or 14 days (heavy soils).

6 Key reasons why wheat is hardened

1. Stimulates crown root development

- Hardening (temporary irrigation pause) forces roots to grow deeper in search of moisture, strengthening the plant's foundation.
- Stronger roots improve nutrient uptake and drought resistance later in the season.

2. Promotes tillering for higher yields

- The stress from controlled water withholding triggers the plant to produce more tillers (secondary stems).
- More tillers = more grain heads, increasing potential yield.

3. Enhances drought resistance

- By acclimating young wheat to mild stress, plants become more resilient to future dry spells.
- Deep-rooted wheat can access subsoil moisture during critical growth stages.

4. Reduces disease risk

- Overly wet conditions in early growth encourage fungal diseases (for example, powdery mildew).
- Hardening dries the topsoil, reducing humidity around the crown and minimising pathogen spread.

5. Prepares the crop for top-dressing and herbicides

- A brief dry period ensures nitrogen fertilisers and post-emergence herbicides are more effective when applied after hardening.
- Moisture resumes post-hardening, activating nutrients and weed-control chemicals efficiently.

6. Hardening helps synchronise growth stages, ensuring uniform maturity at harvest.

- Roots: Forces roots to grow deeper for water, improving drought tolerance.
- Tillering: Stimulates production of secondary stems (tillers), boosting yield potential.
- Disease control: Reduces surface humidity, lowering fungal disease risks (for instance, powdery mildew).

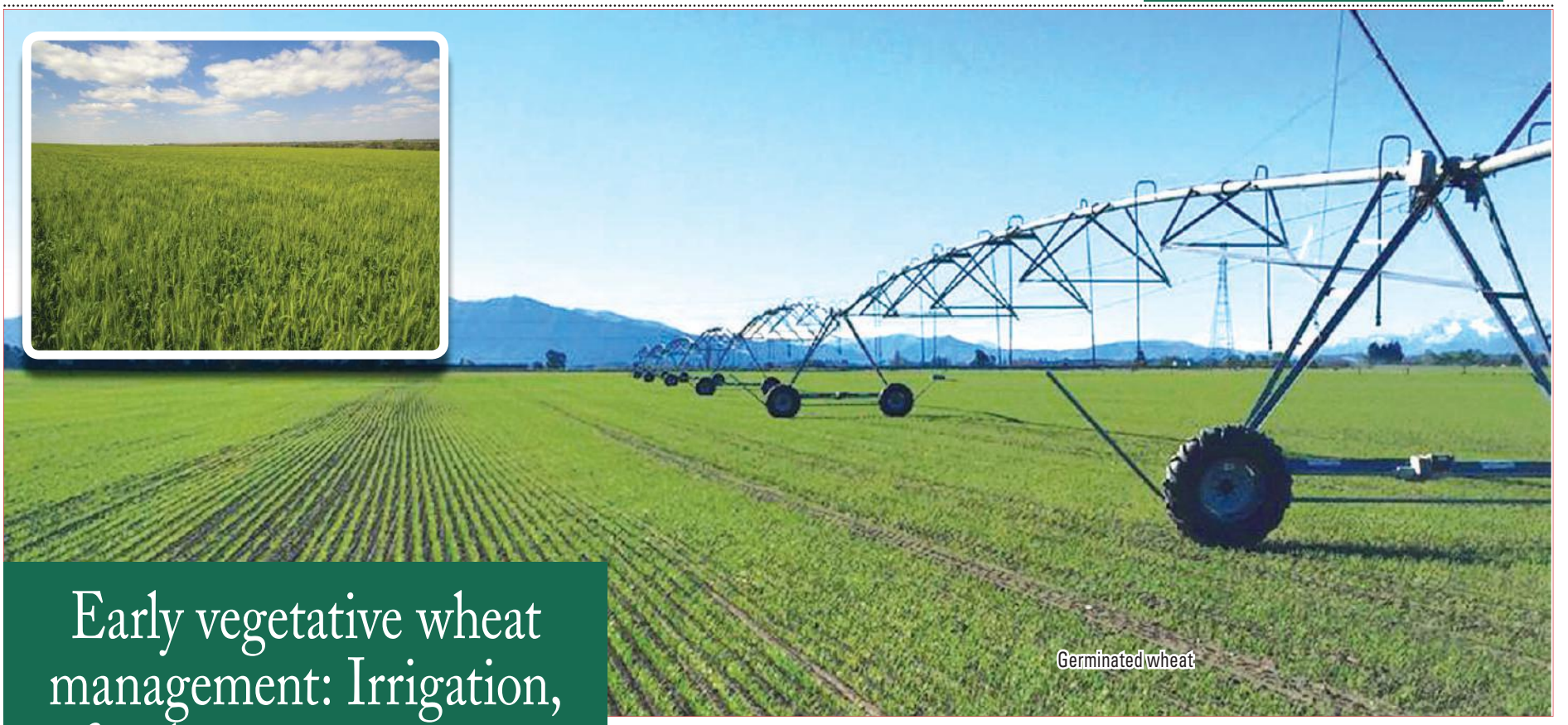
Post-hardening care

Farmers are advised to follow the hardening process with a light irrigation, which reenergises and reactivates growth. Nitrogen fertilisers should then applied to support tiller and leaf development. We encourage farmers to resume irrigation to prepare the plants for tillering - Sandy soils: Irrigate every 7–9 days (30–35 mm/cycle), Clay soils: Irrigate every 10–14 days (40–45 mm/cycle). After hardening, light irrigation resumes, followed by top-dressing (nitrogen application). It's a cornerstone of premium wheat production in arid or irrigated systems

Top-Dressing (14–21 Days after Emergence)

This should be guided by results from soil analysis. Nevertheless, when the soil

• To Page 3



Germinated wheat

Early vegetative wheat management: Irrigation, fertility management, hardening and weed control

• From Page 2

analysis was not done farmers can use a blanket general recommendation of applying 350–500 kg/ha urea or ammonium nitrate. In Sandy soils application can be split into two applications (14 and 35 days after emergence).

Tillering in wheat

Tillering is a critical growth stage in wheat where the plant produces secondary shoots (tillers) from the base of the main stem. These tillers develop their own roots, leaves, and eventually grain heads, directly influencing yield potential. Tillering Matters each tiller can produce a grain head, so more tillers = more potential yield. Optimal tillering ensures uniform head density, maximising grain production per hectare. Tillers act as "backup stems" if the main stem is damaged by pests, disease, or weather. A well-tillered crop can compensate for poor initial plant stands, and also tillers help the plant capture more sunlight (for photosynthesis) and utilise soil nutrients more efficiently.

When tillering happens

- **Starts:** — 14–21 days after emergence (at the 3–5 leaf stage).
- **Peaks:** Around 30–40 days after planting (varies by variety and environment).
- **Ends:** By the stem elongation (jointing) stage this depends with variety

Only healthy tillers (usually 2–4 per plant) survive to produce grain; weaker ones are naturally aborted. Tillering is triggered cool temperatures. The most ideal temperature range is–20°C (which is common in early winter wheat growth) and warmer temps are known to reduce tillering (>25°C).

Weed Control

Wheat follows different crops which include maize, sugar beans, soya beans or sunflower and sorghum. It is advised to apply herbicides after hardening (2 weeks post-emergence). One should proceed herbicide application with a light irrigation for activation. Weed spectrum, density determines the type of herbicide to apply. Broad type of herbicides eliminates broad leafed weeds, volunteer maize, volunteer soya beans

Conclusion

Early vegetative management, particularly hardening and weed control, is foundational for high-yielding winter wheat. Wheat need proper planning and execution timely planting (mid-April to May) Strategic irrigation (hardening phase critical for root development). Balanced fertilisation (basal + top-dressing for protein and yield). A wise farmer applies nitrogen at tillering onset. By adhering to these practices, farmers can ensure strong tillering, drought resilience, and premium grain quality. It is key to adapt with recommendations given towards local stages (tillering, flowering) with optimal temperatures, minimising disease/pest pressure. Soil moisture monitoring should not be ignored in wheat production and one can use an auger to check irrigation effectiveness or use moisture probes. During early vegetative growth to mid vegetative growth it is very important to scout regularly for pests, diseases, and nutrient deficiencies. A good farmer is one who keeps records. Farmers must keep track of water, fertiliser and chemical applications for future optimisation.

AGRICULTURE JOURNAL

Editor's Note

As the crisp air of autumn gives way to the promise of winter, we find ourselves at a pivotal moment on the agricultural calendar—the planting of winter wheat.

This season marks not just the sowing of seeds, but also the cultivation of hope for the coming year.

Wheat is essential for national food security and nutrition, serving as a staple food worldwide.

The winter crop provides a significant portion of daily calories and protein, playing a crucial role in supporting growth and development.

Wheat-based foods, whether whole or refined, contribute to a balanced diet and offer numerous health benefits to the nation as a whole.

Incorporating wheat into our diets not only supports individual health but also strengthens community resilience and food systems.

As we prioritise wheat production, we ensure that we meet the nutritional needs of current and future generations.

By boosting local wheat production, the country does not only meet dietary needs but also reduces food imports.

This enables the country to conserve essential foreign currency and reallocation of resources to other critical areas of need.

This not only strengthens the economy but also supports local agricultural development.

In this issue, we delve into the practices and innovations surrounding winter wheat, exploring the challenges and triumphs that you face as farmers as you prepare your fields for the season ahead.

It is essential to highlight the importance of adhering to correct agronomic practices during this critical time.

Proper soil preparation, nutrient management and pest control are vital to ensuring that your winter wheat thrives and yields a bountiful harvest.

Moreover, sticking to irrigation schedules cannot be overstated. Consistent and appropriate irrigation practices help maintain optimal soil moisture levels which are crucial for seed germination and root development. Understanding the specific water requirements of winter wheat at different growth stages can significantly enhance your crop's resilience against adverse weather conditions.

As a nation, we celebrate the resilience of our agricultural community and the vital role that winter wheat plays in our food systems.

From soil health to sustainable practices, our features highlight the dedication and expertise of those who work tirelessly to ensure a successful harvest.

As you turn the pages, we invite you to reflect on the interconnectedness of our environment and our food sources. May this winter planting season inspire you as much as it inspires us, reminding us all that through diligence and adherence to best practices, we can cultivate not only crops but also a sustainable future

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Dairy cows feeding

The case for pregnancy diagnosis

Eddington Gororo

The main breeding season for cattle in Zimbabwe runs from December to March. With the advent of the dry season and its challenges, farmers must make management decisions about which cows to retain in the herd, cull, re-breed, or prioritise for strategic supplementation.

After breeding, it is important to know the pregnancy status of each cow. This is because not all mated or inseminated cows conceive; some remain empty. This is important for assessing the effectiveness of the breeding programme, and management decisions regarding the animals.

Methods of pregnancy diagnosis

There are three main ways to perform PD: non-return to heat; rectal palpation; ultrasound scanning; and blood or milk tests. The best time for pregnancy diagnosis is about 45–60 days after the end of the breeding season. This ensures accurate detection while giving you enough time to act—either rebreed, supplement, or sell before cows lose too much condition.

With rectal palpation, the technician or veterinarian feels the uterus through the rectum to detect pregnancy. This is the easiest, fastest, cheapest, and most accurate method of heat detection under field conditions. Its accuracy may be as high as 95%.

An ultrasound-scanning machine is used to see the foetus inside the uterus and estimate the age of the pregnancy. This method allows for the early detection of pregnancy and has a high accuracy level of 99%.

Under field conditions, test kits to detect pregnancy hormones in blood or milk are available on the market. These depend on an assay for progesterone, pregnancy specific protein P (PSPB), serum pregnancy associated glycoprotein (PAG), oestrone sulphate, Interferon-tau (IFN-t)5 and other proteins associated with pregnancy.

However, errors in hormone measurements may stem from uterine infections, persistent corpus luteum, cystic ovarian disease, and incorrect handling of the samples and the test kit. Thus, pregnancy should be confirmed later by rectal examination or ultrasound.

As a farmer, you can pregnancy check your own cows using the heat detection method. This is an easy and least costly approach for determining non-pregnancy early after breeding or insemination. Stockmen must regularly check the animals. The absence of oestrus (heat) signs around three weeks after service or insemination implies that the cow could be pregnant.

However, relying solely on this latter method to diagnose pregnant cows is unreliable due to false heats in some; non-pregnant cows not cycling due to uterine infections and ovarian cysts; silent or missed heats; and early pregnancy losses. This is why non-return to oestrus in commercial systems is determined at about 56 days.

Utilising PD results

Information on the pregnancy status (+/-) of each breeding cow will help guide management decisions related to nutrition, health and disease management, culling, and evaluating herd reproductive performance and bull fertility.

Pregnant cows are retained in the breeding herd and prioritized for strategic winter protein supplementation. In order for a cow to be a productive member of the herd, she must have a calf every 12-14 months. Feeding cows that are not carrying a calf is a waste of resources. Knowing which cows are pregnant also helps plan for calving and group cows for efficient grazing or paddocking.

Open (non-pregnant) cows are passengers and an economic liability to maintain until the next breeding season. You need to identify these open cows early so that you can make culling decisions before they start losing weight and improve their body condition. Priorities for culling include open cows that are old, have a history of missing pregnancy, are in poor condition, or have other reproductive problems. An open cow is not necessarily a lost cause. If she is still in good body condition and healthy, you may give her another chance with the bull in a second, shorter breeding season of 6–8 weeks between May and July. Alternatively, you can hire the services of an artificial insemination service provider.

Pregnancy diagnosis also facilitates the early identification of cows and bulls with reproductive and fertility problems and issues. This helps assess herd fertility, remove problem animals, and improve reproductive efficiency over time.

Counting the cost

The cost of a pregnancy diagnosis is small compared to the potential savings. It costs US$3 -US$5 to pregnancy check each cow using rectal palpation or ultra-sound scanning. When using a pregnancy kit, it may cost anywhere from $6 to $10 per cow.

There are also economic benefits to performing PDs. The savings come from protein supplements foregone; elimination of unnecessary retention costs associated with non-pregnant cows; and improved calving rates of up to 5% per year.

Summary

Pregnancy diagnosis is a smart management tool that helps you quickly decide which cows to cull, re-breed, or supplement; plan for the next calving season; and improve fertility and reproductive efficiency of your herd over time.

Every open cow represents a loss in calf production, but early PD gives you a chance to recover or minimise that loss.

This is the best time to talk to your local veterinary officer, livestock specialist, or reproductive technician about organising a PD visit. A few minutes per cow could save you a whole season of wasted effort and expense.

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Guide to carrot farming

Maturity Category	Days to maturity	Variety
Medium	70 – 120	Kuroda, Chantenay, Cape Market, Nantes
Early	85 - 95	Laguna, Star 3006

Soil pH	Planting time/ Temp.(oc)	Seed rate per hectare	Sowing depth (mm)	Spacing (mm)		Comments
				Row	In row	
5.5-6.8.	• Lowveld during the winter months • (April-Aug) Middle and highveld all year/when rains not too heavy 15 –21 oC	4-8 kg/ha		• 300-500 depending on the scale of production	• 25-140 depending on the scale of production	• Drill in and thin out rows. Initial thinning to 58cm after drilling, then final thinning.

Land preparation
- Essential that the soil is brought to a fine tilth, because seed is sown direct into the field.

Fertiliser Requirements
- Depends on soil analysis results and or soil fertility history.
- Basal application, 300-600kg / ha Maize Fert (7:14:7) or 700 kg/ha Coffee Fert (14:5:20).
- 100 — 200 kg/ha Double Superphosphate where available phosphate levels are low.
- Incorporate old, well decomposed well-leached manure at 10-20 tonnes per hectare at sowing.
- Top dressing not usually required after planting, on sandy soils, or where there has been leaching of nitrogen apply 100-150 kg AN 6 weeks after sowing.

Irrigation
- Frequent after germination and during the early stages of growth, thereafter 35 mm — 55 mm every 7-14 days.
- Irrigation should be 35 — 55 mm every 7 - 14 days depending on soil type and temperature conditions.

Weeds, Pests and Diseases
Chemical, cultural practices, natural and biological control practices.

Harvesting
- Lift 3 to 4 months after sowing, when roots are about 2 cm diameter.
- Loosen soil with garden fork, plough or hand harvest by pulling.
- Harvest earlier for baby carrots.
- Harvest during cooler time of the day and keep in a cool place or sprinkle with water to maintain the freshness.
- Cut off foliage, grade and pack as per market requirement.

Yield
- 25 tonnes /ha or more with good management.

Storage
- Carrots can store for 6 months at about 00C and 93-98 percent relative humidity

Marketing
- Local markets as fresh produce.

MINISTRY OF LANDS, AGRICULTURE, FISHERIES, WATER AND RURAL DEVELOPMENT
Field and Horticulture Crops Handbook for Farmers

Veterinary facts on animal diseases and prevention

Vitamin E/ Selenium deficiency

This is a disease, primarily of young sheep and cattle.

Vitamin E/selenium deficiency, also known as White Muscle Disease, is caused by inadequate dietary levels of either selenium or vitamin E or a combination of both.

In the body, selenium and vitamin E form part of various enzymes which protects cells. Deficiency results in breakdown of skeletal and heart muscle fibres.

Occurrence

Although most cases develop during spring and summer vitamin E/ selenium deficiency may occur all year round.

The disease is most common in rapidly growing animals of two to four months of age born from mothers which have been grazing selenium deficient pasture and/or fed diets low in selenium and vitamin E.

Lambs are most susceptible but the disease also occur in calves and in beef up to 18 months of age under feedlot conditions.

The disease occurs clinically in an acute or subacute form. Unaccustomed exercise, vaccination or dehorning procedures are precipitating factors.

Clinical signs

The acute form mainly affects the heart and affected animals may die without showing any premonitory signs of illness especially after unaccustomed exercise. When observed, the clinical signs are as follows:

- Dullness and severe respiratory distress
- Frothy and blood-stained nasal discharge
- Lateral recumbency
- The temperature, eyesight and temperament remain normal
- Death usually occurs within 6 to 12 hours

The subacute form mainly affects the skeletal muscle and the clinical signs are as follows:

- Stiffness and trembling of the limbs
- Weakness and inability to stand for more than a few minutes
- Stiff, goose-stepping gat
- Temperature remains normal and laboured breathing may occur

Subclinical cases occur in apparently normal animals during an outbreak. Primary selenium deficiency may also cause retained placenta and in young animals' weakness, diarrhoea and unthriftiness.

Post mortem

The skeletal or heart muscles show defined white or grey areas of tissue degeneration with the appearance of fish flesh. These lesions may be in steaks and involve all or part of a muscle. Lung oedema may be present.

Diagnosis

A presumptive diagnosis is based on the history, clinical signs and post mortem findings. Blood and muscle samples can be taken and sent to the laboratory for examination. Increased level of muscle enzymes in blood serum and presence of muscle damage observed by microscopical examination are confirmatory of vitamin E/selenium deficiency. Levels of selenium can be estimated in the blood.

Treatment

Intramuscular injection of a mixture containing 2, 5 mg selenium and 750mg of vitamin E (tocopherol acetate) per 45kg body weight is recommended. Following treatment, affected animals usually show marked improved within 3 to 5 days and are able to walk unassisted. Treatment of all animals at risk should be done.

Control

The disease can be prevented by injection of vitamin E/selenium mixture to ewes and dams during pregnancy or directly to the young animals at 1 week of age followed by a second injection two to three months later. Incorporation of vitamin E and selenium in mineral mixture effectively prevents the disease. Vitamin E oil can be added to the diet.

Iodine deficiency (Goitre)

A condition causing abortion, stillbirths or weak offspring

Certain areas in Zimbabwe are iodine deficient in the soil and goitre occurs when animals are fed on a diet which contains insufficient amounts of iodine. Goitre is a swelling on the ventral aspect of the throat caused by enlargement of the thyroid gland.

Occurrence

Low dietary iodine is not the only cause of goitre. Certain feeding system can also be directly responsible for iodine deficiency in animals: for example diets rich in cabbage, rape, and linseed meal or soybean products.

Such diets and highly fertilised star grass contain glycosides which interfere with the uptake of iodine by the thyroid gland and cause enlargement of the organ.

Iodine deficiency may cause increased incidence of abortion, stillbirths and low survival rates in new born animals. Sheep and goats are more susceptible to Iodine deficiency than cattle, pigs and horses. Animal lambing or kidding for the first time are more likely to bear goitrous offspring than adult animals.

Clinical signs

The most obvious symptom is goitre, but abortions, stillbirths and birth of weak offspring are common manifestations of Iodine deficiency.

The offspring usually are unable to stand or suckle and die within a few days of birth. Adult animals often look healthy but the herd experiences an increased incidence of anoestrus, repeat breeding and low libido in bulls.

Post mortem

The thyroid gland is enlarged to two or three times its normal size. In young animals partial or total absence of the hair coat may be seen.

Diagnosis

The presence of goitre makes diagnosis easy. The history of the farming area, type of pasture and feed use are useful aids.

Treatment and control

Iodine deficiency can be prevented by providing animals with a salt lick containing 0.02 percent potassium iodate. The amount of goitrogenic food in the diet should be reduced.

Grain overload in ruminants

This is usually a fatal condition due to ingestion of feed with high contents of carbohydrates

Grain overload or ruminal acidosis occurs in cattle and small ruminants which suddenly ingest large amount of carbohydrates-rich feed such as maize, wheat or molasses.

It causes an acute disease due to excessive production of lactic acid in the rumen. The pH of the ruminal content drops from the normal values of 6-7 to below 5.

The lowered pH destroys the ruminal microflora and impairs the ruminal motility.

Occurrence

Ruminal acidosis occurs throughout the year but is especially common during the winter months, when animals are feed concentrates.

Accidental access to concentrate feed is the most common cause of ruminal acidosis but mixing of concentrate for instance maize corn and roughage in the winter in the wrong proportions may also result in ruminal acidosis.

Over engorgement in animals following a period of starvation can also be responsible for development of ruminal acidosis. Low-grade ruminal acidosis is not uncommon in feed-lot cattle or dairy cows on high concentrate feeding which at the same time get inadequate supply of roughage.

Clinical signs

Usually clinical signs occur within one to two days after engorgement and they are as follows:

- Loss of appetite, depression and weakness
- Body temperature usually remains normal
- Respiration and pulse accelerate
- Immobilised rumen and dehydration
- Diarrhoea and grain may appear in faeces
- Recumbence followed by coma and death

Mildly affected animals show less pronounced symptoms and usually recover after three to five days. Such animals may develop inflammation of hoofs resulting in irregular outgrowth of the claws weeks or even months later.

Post mortem

In acute cases which die within one to two days, excess grain and fluid may be found in the rumen. The content has a typical odour suggestive of acid

• To Page 7

Veterinary facts on animal diseases and prevention

• From Page 6

fermentation. Estimation of ruminal pH values below 5 strongly suggest ruminal acidosis. Shortly after death the rumen pH begins to increase and froth is present in the trachea. Fluid may be seen in the heart sac and the chest cavity.

Treatment

In serious grain overload emergency slaughter should be considered. In moderately affected cases, 50 gram of magnesium hydroxide in 1 litre of water per 100kg body weight is drenched into the rumen of followed by kneading of the rumen to promote mixing.

Water intake should be restricted for the few days and good quality palatable hay provided equal to one half of the daily allowance per head.

Exercise every hour encourages movement of the ingesta through the digestive tract. Treatment with antibiotics and adding of electrolytes in the drinking water may reduce problems with ruminal inflammation.

Urea Poisoning in ruminants

This is usually a fatal condition if urea is fed in high concentrations or not introduced gradually to the animal.

Urea poisoning is an acute often fatal intoxication of cattle, sheep and goats due to excessive breakdown of dietary urea and formation of ammonia in the rumen.

Presence of soy-bean meal in the feed increase the ammonia formation.

Urea is used as a feed additive in ruminants to provide a cheap protein substitute. Urea also serves as a fertiliser on crop and pasture fields.

Urea poisoning occurs if urea is not gradually introduced into the animals' diet so that the ruminants can get accustomed to it.

Urea poisoning also occurs when ruminants accidentally gain access to large quantities of urea, or when ruminants accidentally gain access to large quantities of urea, or when feeds are improperly mixed.

It should be kept in mind that tolerance to urea is lost rapidly and animals which do not receive urea for a few days are fully susceptible. The diet must contain adequate amounts of carbohydrate when urea is fed.

Clinical signs

Signs of illness occur within 20 to 30 minutes after ingesting a toxic amount of urea and the symptoms are as follows:

- Severe abdominal pain
- Weakness and laboured breathing
- Excessive salivation and bloat
- Muscle tremor, incoordination and staggering backwards
- Violent struggling and bellowing

The course is short and death usually seen in the form of generalised congestion, froth in the trachea, lung oedema and increased fluid of the heart sac.

Haemorrhages may be present on the heart surface. Ammonia dissipates rapidly but ammonia odour may be emitted from the opened rumen. The pH of the rumen content may be over 7.

Diagnosis

A diagnosis is based upon the history of urea ingestion and post mortem findings. Often several animals are affected at the same time. Toxic levels of urea in feed can be verified by chemical analysis.

Treatment

If not administered early, treatment is unlikely to be effective, however, oral administration of half to one bottle (sheep), three to four bottles (cattle) of vinegar or 5 percent acetic mixed with equal amount of water and drenched to the animal may be tried.

Repetition of the antidote is recommended as clinical signs tend to recur about half an hour after treatment.

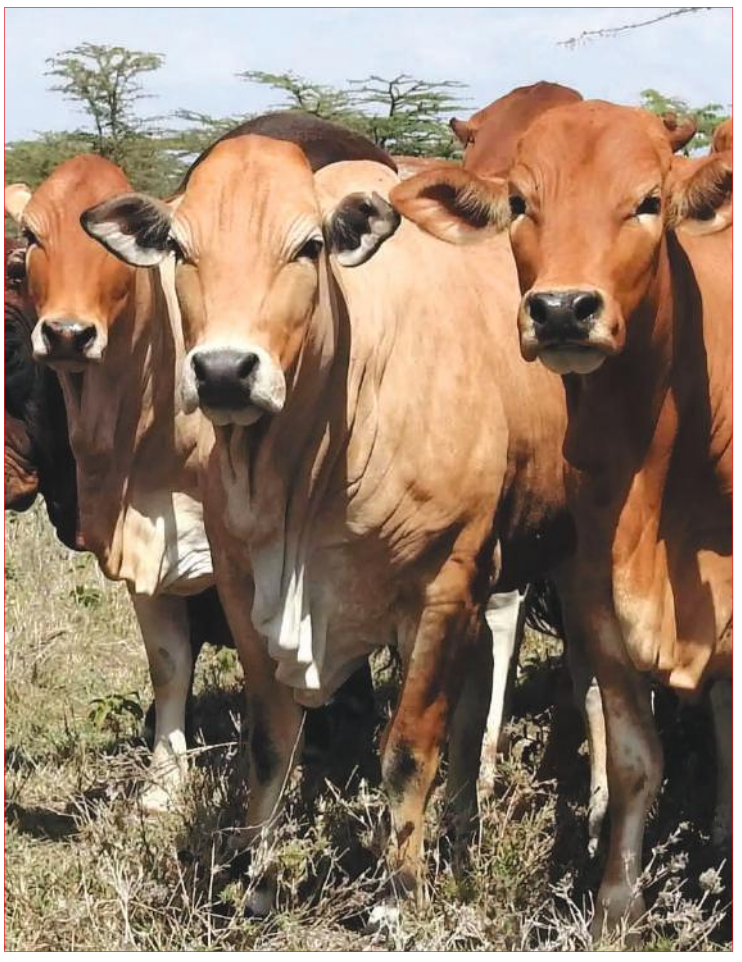
Prevention

In general urea should not constitute more than 3 percent of dietary concentrate, or 1 percent of the total dry ratio.

As a rule of thumb, an adult cow should not be given more than 60 grammes of urea per day.

Urea must be introduced slowly to animals and evenly mixed in the feed.

Urea fertiliser should be kept away from animals.



Herd of cattle

Goats

Seedbed reminders – Part 1

Dr Rob Garvin

MOST growers will have fumigated seedbed sites by now as the new season starts with bed sowing (at least of the irrigated crop) less than a month away. At the risk is being repetitive, the importance of transplanting healthy, robust, well hardened seedlings for the whole crop cannot be over-emphasised. TRB research showed that if substandard, short seedlings (10 to 13cm in length in the case of conventional seedlings) are transplanted, yield could decline by as much as 20%. Good seedling production is multifaceted and starts with correct seeding rate and sowing (assuming the beds are made up to the correct specs).

Tobacco seedlings

Population and seeding rate

Whilst tobacco seed size varies from season to season and between varieties, the average number of seeds/g for KRK66 is around 14 000. This also applies to most of the other varieties grown, with the exception of KRK26, 28 and 29 which are approximately 10-12% smaller.

The TRB Handbook recommends a population of 450-500 seedlings/m2 which will provide the correctly proportioned seedling for transplanting viz. 12-15cm root crown to growing point, pencil thick with no more than 8-10 leaves. Recently growers' experience has suggested that a thicker, more robust seedling is more suitable. Interestingly, TRB research showed that there was no difference in pullable seedlings at the first pulling when population varied from 350 to 500 plants/m2. This suggests that population could be reduced to say 350-400 plants/m2, which would then provide a thicker seedling.

Assume one then aims for a final population of 400 plants/m2 and working on the stated germination for certified seed (90%), the amount of seed required would be 0.032g/m2 (400/14 000/0.9) or 1.14g/36m2 bed. However, the final seeding rate depends on the type of mulch. If using grass mulch alone, germination may be as low as 60%, whereas with grass and nappy liner expect 80%. Stone (6-8mm chips) mulch alone will be the same. Stone with nappy liner will be around 90%.

Typically, most growers use tents or nappy liner with grass. In this case seeding rate will be 1.43g/36m2 bed (1.14g/0.8). If stone is used under nappy liner or tents, this will be 1.27g/36m2 bed (1.14g/0.9). Note that this applies to KRK66, if KRK26 is sown then with the smaller seed will need to aim for 1.26g/36m2 (grass) and 1.12g/36m2 (stone). Growers own past experiences on seeding rate used and resultant population is also a useful consideration when deciding on rates.

Weighing seed without a sophisticated laboratory scale is not easy, but there is a simple means of getting an accurate measurement using volume.

1g seed is the equivalent of 1.8ml

Therefore, as an example, to measure 1.43g/bed will need a volume of 2.57ml (say 2.6ml) which is easily measured using a hypodermic syringe.

Small, accurate low weight scales are usually available from certain outlets however. Where cross referencing is done to check that a certain number of beds comes from say a 50 g seed packet, it is important to pre weigh the contents of the packet as packets usually weigh a small percentage above the stated weight (in the case of 5g packets this can be a significant percentage)

Seedbed area

In the 1970s TRB recommended seedbed area was 75m2/ha. At a population of 400 plants/m2 would need at least 50% pullable seedlings for the first pulling (15 000/30 000 x 100) per ha (15 000 plants/ha). At that time on-farm TRB research found that the better growers were sowing at least 90m2/ha and the TRB adjusted their recommendations accordingly. At this rate one will need 42% pullable seedlings (15 000/36 000 x 100) for the first pulling. In those days most of the crop was dryland, usually planted over 3-4 weeks. This meant there was time for seedlings to recover (often they were given further fertiliser to encourage growth) and therefore at the end of planting there were still sufficient reasonable seedlings for transplanting. Nowadays the crop is usually planted over a shorter period, with most crops planted in 10-14 days. Often if seedbed area is insufficient, as much as 25% of the crop may be planted with substandard seedlings. Increasing seedbed area to 120m2/ha (or more) will mean that the first (and often only pulling) will require 32% pullable seedlings, which should mean (with good seedbed management) sufficient quality seedlings for the crop.

Sowing

Uniform distribution of seed is vital if a high percentage of pullable seedlings are to be available at transplanting. If poor bed preparation or sowing results in "clumps" of seedlings it is virtually impossible to achieve sufficient pullable seedlings, regardless of seedbed area. Ensure that the bed surface is uniformly level, slight roughed (coarse yard broom does a good job) if grass mulch is used; smooth (but not compacted), if stone chips are the mulch choice. Sowing may be done using a single or double can boom or with an adapted water cart or spray boom and tractor. Regardless of which method used, the flow of seed onto the bed must be uniformly distributed and constant. Puddling of water on the seedbed surface when sowing must be avoided to limit seeds draining into small clusters. Divide the seed for one bed into 4 equal portions. Place one portion in the container. Never place the seed in the container first, always half fill with water, pour in the seed agitating constantly and then fill the container with water. With the single can and tractor system suggest a single pass over the bed, requiring 4 passes to complete the required seed for the bed, starting on opposite ends each time. With the double can, 2 passes there and back is feasible. The boom must be level. Once the seed is completed, fill with clean water and repeat once.

Germination

Like many plant seeds, tobacco is subjected to a phenomenon known as dormancy which must be "broken" before successful germination. Normally if the seed is kept in storage under the correct conditions for 3 to 4 months, dormancy will break and the seed will germinate. This is why "fresh" seed (recently harvested) sown, often takes a long time to germinate, a problem growers have encountered in the past.

There are 3 main factors that are important if germination is to be successful.

Light: tobacco requires a certain amount of light for germination which is why it is sown on the soil surface. TRB research showed that 10 days after sowing only 20% of seed germinated in the dark compared to 93% when in light. This is why if mulch is too thick, germination tends to be uneven and erratic (see below).

Moisture: absorption of moisture by the seed is essential for germination. Because tobacco seed is so small it is unable to store much moisture and therefore is sensitive to minor fluctuations in water availability. Having absorbed sufficient moisture to initiate germination, the critical period occurs when the radical (root) emerges to penetrate the soil sufficiently to absorb moisture. Any drying at this stage will affect final population. If the soil is dry for no more than 4 hours at this time the germinating seed will die. This why it is so critical to keep the surface of the soil moist (but not saturated) during germination.

Temperature: tobacco seed will germinate from 10oC to 32oC, but the optimum temperature ranges for most rapid germination is 18-23oC. In this country, although day time temperature (even in winter) fall into this range, night temperature is appreciably lower hence the use of tents or nappy liner. However, even these only have a temporary effect in maintaining warmth at night which is why seedbeds sown in June/July are inclined to be slow germinating. In warm conditions the root will emerge in 60-72hrs, whereas if cooler this will take up to 100 hrs (this is why it is so critical not to be short of water 4-5 days after sowing as this is when the root appears – often this time coincides with the weekend when water management may not be as well monitored!)

Mulching

The primary benefit of mulching is to decrease moisture evaporation at soil level where the germinating seed is positioned. It also increases temperature. Mulch protects the young seedlings from water droplet damage. However, as has been indicated above, light is an essential prerequisite for germination so that the mulch must be distributed such that a uniform amount of light reaches the seed.

Grass mulch: it must be fine stemmed, non-leafy, cut to lengths of around 20cm for ease of distribution. Once the grass is distributed on the bed, it should be no thicker than, when viewed vertically, the soil is visible through the grass. Often initial mulching is too thick and uneven and normally thinned only once the seedlings are visible. This is too late as the damage inflicted by erratic light penetration has occurred and germination will be uneven. Suggest once the grass has been spread, spend time ensuring that it is correct before watering.

Virtually all growers use nappy liner. This in itself has a mulching effect and it is not necessary to have the grass mulch thick, in fact it can be thinner than when used without the nappy liner. The mulch also assists in keeping the nappy liner off the seedling which can result in cold damage issues.

Stone mulch: using a single layer of 6-8mm quarry stone chips makes an effective mulch. TRB research showed that germination under stone mulch was higher and more uniform compared with grass mulch hence the recommendation to reducing seeding rate. However, it was also found that germination was slower with stone because the stone chips lost heat faster than grass at night. However, this was pre-nappy liner days and growers' experience now suggests that there is little difference.

The author is a member of the Zimbabwe Tobacco Association (ZTA)

Reviving rural economies through high-value horticulture: opportunities and challenges

Desire Tavengwa

IN an era marked by rapid urbanisation and industrial growth, rural areas across the globe, particularly in developing countries, continue to grapple with economic stagnation, limited employment opportunities, and poor infrastructure. Agriculture remains the backbone of these rural economies, yet traditional farming practices focused on staple crops often fail to deliver significant income and employment. One of the most promising solutions to revitalise rural economies lies in the promotion of high-value horticulture (HVH). This agricultural model, centered around the intensive production of fruits, vegetables, herbs, spices, and ornamental plants, presents a viable alternative for driving income generation, job creation, and overall economic growth in rural settings.

Understanding high-value Horticulture

High-value horticulture refers to the cultivation of crops that generate more revenue per unit area compared to staple crops like maize, wheat, or rice. These include a wide range of produce such as tomatoes, onions, chilies, berries, exotic fruits, flowers, and medicinal herbs. The value of these crops is derived from their market demand, nutritional benefits, aesthetic appeal, and suitability for processing and export. HVH is characterised by intensive cultivation, frequent harvesting cycles, and a need for careful handling and post-harvest management. It supports diversification in agricultural production and opens avenues for value addition and agribusiness development.

Opportunities presented by high-value horticulture

Enhanced Farmer Incomes

High-value horticultural crops command premium prices in both local and international markets. Smallholder farmers cultivating vegetables like tomatoes or high-demand fruits like avocados can earn significantly higher returns per hectare than they would from staple crops. This income boost can lead to improved livelihoods, better access to education and healthcare, and enhanced investment in farm inputs.

Employment generation

HVH is labour-intensive. From land preparation and planting to harvesting and packaging, horticultural production provides employment at nearly every stage of the value chain. It not only creates jobs for farm labourers but also opens opportunities in logistics, processing, retail, and export sectors, thereby stimulating the broader rural economy.

Market diversification And trade

With the rise of urbanisation and changing dietary patterns, there is increasing demand for fresh and processed horticultural products. Additionally, the global market for exotic fruits, organic vegetables, herbs, and flowers is expanding. Countries that strategically invest in HVH can tap into lucrative export markets, generating foreign exchange and fostering agribusiness development.

Climate resilience and Sustainability

Many horticultural crops have shorter growing cycles than traditional staples. This allows farmers to respond more flexibly to seasonal changes and market conditions. Diversification through HVH also reduces dependency on a single crop, enhancing resilience to climate shocks and price volatility. Moreover, with good agricultural practices, HVH can be more sustainable and water-efficient when integrated with modern irrigation technologies.

Empowering women and youth

Women and youth are key players in horticultural value chains. From nursery operations to processing and marketing, HVH offers accessible entrepreneurial opportunities. With land often being a limiting factor, the relatively small land requirements for many horticultural ventures make them suitable for marginalised groups in rural areas. Encouraging their participation helps promote inclusive rural development and addresses youth unemployment.

Value addition and Agro-processing

HVH is an excellent foundation for agro-processing enterprises such as fruit drying, juice production, spice grinding, and flower preservation. These enterprises add value to raw produce, extend shelf life, and improve marketability. The resulting economic activities can revitalize rural towns and create additional revenue streams.

Challenges to high-value Horticulture development

Despite its potential, the adoption and expansion of HVH face several significant hurdles.

Limited Access to Quality Inputs and Technology

Access to certified seeds, fertilisers, agrochemicals, and irrigation equipment remains a major challenge for rural farmers. Inadequate extension services further exacerbate the problem, leaving farmers ill-equipped to manage pests, diseases, and post-harvest losses effectively. Without proper knowledge and inputs, productivity remains low and quality is inconsistent.

Inadequate infrastructure

Most rural areas lack the necessary infrastructure to support high-value horticulture. Poor roads hinder access to markets, while inadequate cold storage and transportation result in high post-harvest losses—often exceeding 30–40 percent for perishables like tomatoes and strawberries. This undermines farmer profits and discourages investment in perishable crops

• To Page 10

Reviving rural economies through high-value horticulture: opportunities and challenges

From Page 9

Unstable markets and price volatility

Fluctuating prices due to seasonal gluts, limited market information, and lack of structured marketing systems pose significant risks to small-scale horticultural producers. Without guaranteed buyers or contract farming arrangements, farmers often struggle to sell their produce at fair prices.

Access to finance and Insurance

Smallholder farmers typically face difficulties in accessing affordable credit due to lack of collateral, limited financial literacy, and perceived risk by lenders. Similarly, there are very few crop insurance schemes that cater to horticultural production. This lack of financial protection discourages innovation and limits the scale of investment in HVH.

Weak policy support and institutional frameworks

In many developing countries, agricultural policies still prioritise staple food security, with limited attention to horticulture. The absence of clear guidelines, incentives, and support mechanisms for HVH restricts its growth. Moreover, weak farmer organisations and cooperatives make it difficult to advocate for collective interests or negotiate better terms with buyers and service providers.

Knowledge gaps and capacity constraints

High-value horticulture requires technical know-how in crop selection, pest management, post-harvest handling, and market standards. Many rural farmers lack this knowledge, and training opportunities are limited. Bridging these knowledge gaps is essential for improving productivity and product quality.

Strategic Interventions for Unlocking HVH Potential

To fully harness the benefits of high-value horticulture and transform rural economies, coordinated efforts are required from governments, development partners, the private sector, and local communities.

Policy reforms and incentives

Governments need to recognise horticulture as a strategic sector in national agricultural development plans. Policies that incentivise private sector investment, facilitate access to finance, and promote market infrastructure development are critical. Tax breaks, subsidies for irrigation systems, and export incentives can also play a transformative role.

Infrastructure investment

Improving rural infrastructure is fundamental. Investments in all-weather roads, rural electrification, irrigation facilities, cold storage, and pack houses will enhance the efficiency and profitability of HVH. Public-private partnerships can be a powerful tool to develop and maintain these assets.

Strengthening extension and research services

A robust agricultural extension system is needed to transfer technology and best practices to farmers. Governments and NGOs should train extension workers in HVH and encourage participatory learning models like farmer field schools. At the same time, research institutions must develop locally adapted varieties and farming techniques that are climate-resilient and market-oriented.

Access to finance and insurance products

Financial institutions should be encouraged to develop horticulture-friendly loan products. Innovations like mobile banking, warehouse receipts, and group lending can help de-risk lending. Additionally, developing tailored crop insurance products will protect farmers from losses due to natural calamities or market shocks.

Market development and linkages

Creating structured markets, including contract farming and cooperative marketing, can stabilise prices and improve farmer incomes. Digital platforms can facilitate price discovery, demand forecasting, and e-commerce, linking rural producers to urban and international consumers. Certification programs and branding (for example, organic, fair-trade) can also boost competitiveness.

Promoting agribusiness and value addition

Encouraging rural entrepreneurship in processing, packaging, and transportation can create multiplier effects in local economies. Business incubation centres, vocational training, and access to start-up capital can help youth and women venture into horticultural agribusiness.

Conclusion

High-value horticulture holds the promise of revitalising rural economies by transforming agriculture into a profitable, employment-generating, and sustainable enterprise.

While significant challenges exist, they are not insurmountable. With the right policies, infrastructure, and support systems, HVH can play a central role in reducing poverty, curbing rural-urban migration, and creating vibrant rural communities.

The road to rural prosperity lies in leveraging what farmers already know—growing crops—but doing it smarter, with higher value, better markets, and stronger partnerships. In doing so, we can truly transform agriculture from a subsistence activity into a thriving engine of rural economic growth.

Launch of the gender-sensitive centre pivot in Domboshava

About Women in Agriculture Union (WAU)

ESTABLISHED in 2019, the Women in Agriculture Union (WAU) is a dynamic, membership-based organisation dedicated to advancing the participation, recognition, and economic empowerment of women in agriculture across Zimbabwe. It is a grassroots-driven initiative, strengthening the capacity of women to produce, process, package, brand and market their agribusinesses.

WAU stands at the forefront of inclusive agricultural transformation, providing women farmers with the tools, knowledge, networks, and visibility they need to thrive in a competitive agro-economy.

Key activities and achievements

Pioneers of the Piglets Pass-On Project

WAU introduced and continues to implement the Piglets Pass-On Project, a flagship livestock empowerment programme.

This sustainable model enables women farmers to receive piglets, rear them, and pass offspring to other members—creating a ripple effect of economic opportunity and food security in rural communities.

Gender-Sensitive irrigation Empowerment

Through strategic collaborations, WAU contributed to the design and deployment of a gender-sensitive centre pivot irrigation system. Recognising the financial challenges faced by smallholder women farmers, it launched a crowdfunding initiative to support the purchase of this system.

This initiative empowered members to invest in:

- Cement and infrastructure for irrigation
- Borehole drilling
- General farm development

This project has improved productivity, reduced labour burdens, and expanded land under irrigation for women-led farms.

Digital storytelling and farmer visibility

WAU actively profiles and showcases the work of women farmers from all provinces via its social media platforms. This strategic digital exposure has significantly boosted the visibility of women in agriculture, leading to:

- Market access opportunities
- Business sponsorships and partnerships
- Increased recognition and leadership roles for featured members

Training, Mentorship & Advocacy

- Conducting technical and business skills training workshops tailored to climate-smart agriculture, agribusiness, and value addition.
- Running mentorship programmes to support knowledge transfer between experienced and emerging farmers.
- Engaging in policy dialogues to ensure that women's needs and perspectives are integrated into national agricultural strategies.

WAU's ongoing impact

- Trained and supported more than 800 women farmers across Zimbabwe.
- Facilitated community-driven resource mobilisation and farm development.
- Increased female representation in commercial agriculture and agribusiness networks.
- Continually pioneering sustainable, replicable empowerment models.

Women showcase their value-added products

Training of women in value addition and food handling in Chinhoyi

Engineer Pritchard Elmon Marozva

MAIZE POST-HARVEST MANAGEMENT FACTS

2.1.1 Harvesting methods Manual Harvesting

Maize cobs can be harvested with or without their husks, depending on how they will be used. De-husked cobs are ideal for human consumption, while husked cobs are suitable for animal feed.

Key steps for minimising losses during manual harvesting

- **Proper stacking:** Ensure stacks allow for good air circulation to prevent mould growth. Avoid compressing the stacks too tightly.
- **Timely de-husking:** De-husk cobs at the optimal harvest time to reduce exposure to field pests and diseases. Don't delay the process.
- **Ground protection:** Prevent cobs from touching the ground to avoid termite damage, cob rots, and soiling. Use clean surfaces like tarps or mats.
- **Thorough collection:** Collect all scattered cobs from the field before loading. This prevents losses and ensures a complete harvest.
- **Sorting and separation:** Immediately separate damaged or diseased cobs from healthy ones to prevent pest infestations and the spread of fungal diseases (moulds). Isolate and dispose of damaged cobs appropriately.

Method		
Feature	**Direct de-husking (de-husking on the stand)**	**De-husking after Drying on Stacks or Windrows**
How it is done	Cobs are de-husked directly from the standing stalk and placed immediately into containers (bags, baskets, etc.) to prevent grain shattering. For larger harvests, cobs may be temporarily piled before transport. Cobs can be carried home in containers or bags for small quantities and fields near the homestead.	Maize stalks are cut and gathered into stacks or windrows. Cobs are left to dry on the stalks for one to two weeks before being de-husked.
Benefits	• Ideal for conservation agriculture, as stover (stalks and leaves) remains distributed in the field. • Saves labour and time compared to cutting and stacking.	• Reduces losses from missed cobs compared to direct de-husking. • Can reduce fatigue as cutting and stacking are done separately from de-husking. • Piling on open ground reduces scattering during loading.
Challenges and loss prevention	• **Careful harvesting:** emphasize to workers the importance of thoroughly checking both standing and fallen stalks to avoid missing cobs. • **Pest control:** be vigilant for pests like the larger grain borer and weevils, and implement control measures as needed. • **Weather protection:** harvest promptly to avoid losses from rain and dew, which can lead to mold growth. • **Shattering prevention:** handle cobs carefully during de-husking and transport to minimize grain loss from impact. Avoid throwing cobs or kernels on the ground. • **Animal protection:** keep stray animals away from the field to prevent them from consuming or damaging cobs left in the field.	• **Pest Control:** Monitor stacks for pests and take appropriate action. • **Shattering:** Handle cobs carefully during stacking, drying, and de- husking to prevent grain loss. • **Weather Protection:** Ensure stacks are protected from rain to prevent mold and spoilage. Stack properly for good air circulation and drying.

Mechanical harvesting

Mechanical harvesting involves the use of a combine harvester which performs various functions in a single go, i.e. cutting the stalks, picking, de-husking, shelling, winnowing, blowing out chaff, cleaning the grain and loading bins/trailers for delivery.

Procedures and guidelines for minimizing harvesting losses

The following guidelines should be observed to minimise harvesting losses:
Pre-harvest:

- **Moisture check:** Ensure maize reaches the optimal moisture content (20- 25%) before harvest.
- **Inspection:** check for mold and rot; remove affected plants.
- **Harvest Planning:** clan harvesting to avoid weather delays.

Harvesting:

- **Cutting technique:** Cut stalks near the base with a sharp machete or sickle.
- **Gentle handling:** Avoid pulling/jerking stalks and handle cobs gently to prevent grain breakage and damage.
- **Clean equipment:** use clean, dry equipment to prevent contamination and moisture changes.

Contamination prevention:

- **Cleanliness:** use clean equipment, wear clean clothing and gloves.
- **Separation:** keep maize separate from other crops and potential contaminants.

Timing and environmental considerations:

- **Moisture content:** harvest at 20-25% moisture to minimize mold and rot.
- **Maturity:** harvest when kernels are mature and husks are dry.
- **Weather:** avoid harvesting during extreme weather (rain, wind, intense sun).
- **Time of day:** harvest during cooler parts of the day.
- **Soil:** harvest when soil is neither too wet nor too dry.
- **Temperature:** avoid temperatures above 35°C or below 10°C.
- **Humidity:** aim for moderate humidity (40-60%).
- **Wind:** avoid strong winds (over 20 km/h).

2.2 Transportation

- Maize can be transported as de-husked or husked cobs from the field to the homestead as bulk or bagged grain. Commonly used modes of transport by smallholder farmers include wheelbarrows, animal-drawn scotch carts, manually — on heads, shoulders, or backs, and trucks. Commercial producers usually use motor vehicles to transport their produce. In all cases, transportation from the field should be done as soon after harvesting as possible, and the crop must be transported in clean and dry containers that do not allow the crop to spill out.

Key Takeaways

- Proper timing and methods are crucial for minimising postharvest losses.
- Drying to the correct moisture content is essential for safe storage.
- Both traditional and modern techniques have their advantages and disadvantages.
- Ventilated cribs are a very good solution for small farms.

Mechanical harvesting of maize using combine harvesters

Different equipment for transporting harvested maize from the fields.

The business and economics of fish farming in Zimbabwe

Introduction

PROPELLED by the increasing domestic demand for fish, declining wild fish stocks, and a growing awareness of the economic and nutritional benefits of aquaculture, fish farming is rapidly gaining traction as a promising agribusiness venture in Zimbabwe. As the nation embraces agricultural diversification and pushes for climate-resilient food systems, various fish species that include tilapia, catfish, and trout, offer viable commercial opportunities for both smallholder and commercial farmers.

This article delves into the core aspects of fish farming in Zimbabwe from a business and economic perspective. It covers key topics such as preparing a Gross Margin Budget, developing sustainable production and marketing strategies, and analysing essential business performance indices. By exploring these elements, aspiring fish farmers can gain valuable insights into maximizing their profitability and contributing to the country's food security.

Farmers typically operate grow-out units, and in some cases, integrate with hatcheries and feed formulation. With the right business acumen, each node offers a revenue stream.

Fundamentals of Fish Farming Economics

a. Capital and Operational Costs

Fish farming in Zimbabwe demands substantial initial and continuous investment.

Capital costs, or capital expenditures, are one-time expenses incurred by a business to acquire or upgrade long-term assets. These include constructing ponds, tanks, or cage systems, as well as procuring water supply infrastructure like boreholes and pumps, and installing aeration and filtration systems. In Zimbabwe, farmers often invest in solar-powered machinery due to unreliable on-grid electricity.

On the other hand, operational costs, also referred to as operating costs, are the expenses a business incurs to sustain its daily operations. These can be categorised into fixed and variable costs. Fixed costs are expenses that remain constant regardless of changes in the scale of production, while variable costs fluctuate based on the level of output or activity. Operational costs are recurring and typically include:

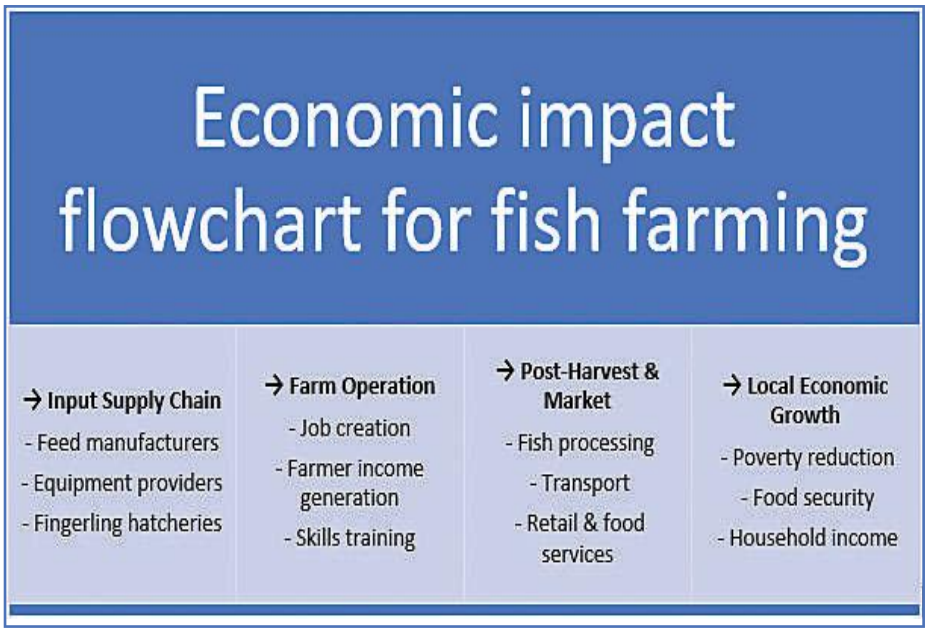
Access to affordable finance remains a challenge. Many smallholders rely on savings, remittances, or NGO-funded projects, as commercial loans are often inaccessible due to high interest rates and stringent collateral requirements.

b. Revenue Sources

The primary income for fish farmers and hatcheries in Zimbabwe comes from the sale of:

- Whole live fish (for example, Nile tilapia, catfish),
- Fingerlings
- Processed fish (fresh fillets, gutted and cleaned),
- Value-added products, such as smoked, dried, or marinated fish.

Secondary revenue streams may include:



Cost Item	Type of Cost	Notes
Feed (accounting for 60–70% of production)	Variable	Increases with the number and size of fish being raised.
Labour (semi-intensive/intensive systems)	Variable	As production levels increase, more fish will require additional labour for feeding and care.
Water pumping and electricity	Variable	Varies with water usage, which depends on system intensity and stocking density.
Cage or pond/tank maintenance and repairs	Fixed	Regular upkeep costs are relatively stable, regardless of output level.
Transport (from input suppliers and to markets)	Variable	Costs depend on the frequency and volumes being transported.
Disease control and biosecurity (veterinary drugs and medicines	Variable	Usage of medication and biosecurity inputs increases with stock levels.
Regulatory compliance fees (EMA, ZINWA)	Fixed	Usually paid annually or per production cycle, not dependent on scale.

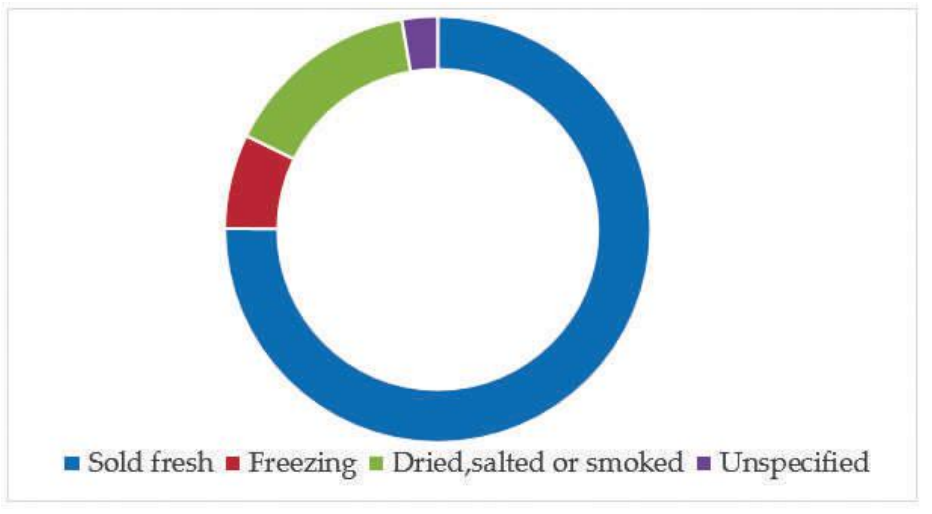


Figure 1: Fish processing and value addition in Zimbabwe (Source: Second Round Crops, Livestock and Fisheries Assessment Report, GOZ 2025)

- Pond or tank rentals, particularly in peri-urban areas,
- Training workshops and farm tours, as part of agro-tourism or extension-linked services.

In urban markets like Harare, processed and filleted fish attract premium prices due to demand from hotels, restaurants, and households. Rural areas typically favour live or whole fish due to limited refrigeration and processing infrastructure.

c. Scale and Profitability

Profitability in fish farming increases significantly with:

- Economies of scale (spreading fixed costs over more output),
- Efficient feed utilisation (low feed conversion ratios or FCR),
- High survival rates and low disease incidence,
- Reliable market access, especially for bulk buyers.

Farmers may adopt:

- Extensive systems (low input, low output, common in rural communal ponds),
- Semi-intensive systems (supplemental feeding, improved water management),
- Intensive systems (high stocking density, full feed ration, often in tanks or cages).

Profitability is sensitive to input prices (especially feed and fingerlings) and market fluctuations. The dry season poses challenges like reduced water availability and increased fish stress, impacting growth rates and harvest timing. Smallholder farmers often combine fish farming with crops or livestock for better resource use, such as using chicken manure in ponds or irrigating crops with nutrient-rich water.

d. Financial Performance and Risk

Key indicators of economic viability include:

- Feed conversion ratio (FCR),
- Cost of production per kg of fish,
- Gross margins and return on investment (ROI).

However, risks remain, including:

- Climate variability, affecting water availability,
- Limited access to quality feed and fingerlings,
- Disease outbreaks due to poor water quality or biosecurity,
- Market access bottlenecks, especially in remote areas with poor road infrastructure.

Government support, donor-funded projects, and private hatchery partnerships can help mitigate some of these risks, but capacity building and financial inclusion are essential for sector growth.

Key Budgets for Fish Farms

1. Gross Margin Budget

A Gross Margin Budget helps assess the profitability of the enterprise by calculating the difference between gross income and total variable costs.

Practical Steps

i. Determine Expected Yield

Estimate production per cycle (e.g., 1,000 kg per 500 m^2 pond per 6 months).

ii. Estimate Gross Income

Gross Income = Expected Yield × Price per kg

iii. Identify Variable Costs

Common cost items include: fingerlings, feed, labour, transport, water, electricity, medication, etc.

iv. Compute Total Variable Costs

v. Calculate Gross Margin

Gross Margin = Gross Income – Variable Costs

Gross Margin allows the farmer to assess the profitability per production cycle before accounting for fixed costs like depreciation.

• To Page 14

The business and economics of fish farming in Zimbabwe

Cash Flow Projection

This projection, whether conducted monthly or quarterly, is essential for ensuring the farm's financial health. It helps track the inflow and outflow of cash, allowing for better planning and decision-making regarding expenses, investments, and overall financial management.

3. Whole Farm Budget

In a diverse rural environment, farmers frequently combine fish farming with livestock and crop production. A whole-farm budget provides an overview of the overall profitability of the entire farm operation. This budget helps assess how different enterprises complement each other and informs long-term investment decisions.

4. Cash Flow Statement

This formal financial statement documents actual inflows and outflows, assisting farmers in evaluating their liquidity and repayment ability. It is important to note that this statement is not necessarily a budget; instead, it reflects real financial activity and provides insights into the current financial health of the farming operation.

Fish cage aquaculture

GROSS MARGIN BUDGET TEMPLATE FOR TWO 20M × 10M FISH PONDS

INITIAL CYCLE

Scale of Production (Number of fingerlings)	
Harvestable Number of Fish	
Average Fish Weight at Harvest (kg)	
Yield (kg)	
Anticipated Selling Price (USD/kg)	
Gross Income (USD)	
Total Variable Costs (USD)	
Gross Margin (USD)	
Return/$Variable Cost	

Summary of Business Analysis Indices for Fish Enterprises

These indices help in tracking performance, decision-making, and attracting investment.

Indicator	Formula	Relevance
Gross Margin	Gross Income – Variable Costs	Measures enterprise profitability
Break-Even Price	Total Costs / Output Quantity	Minimum price to cover costs
Return on Investment	(Net Profit / Total Investment) × 100	Investment attractiveness
Feed Conversion Ratio	Feed Used (kg) / Fish Produced (kg)	Efficiency of feed use
Benefit-Cost Ratio	Total Revenue / Total Costs	Measures overall project viability
Net Present Value (NPV)	Present Value of Benefits – Present Value of Costs	Long-term project profitability
Internal Rate of Return (IRR)	Discount rate where NPV = 0	Measures expected profitability

Variable Costs

Item Description	Unit of Measurement	Quantity	Unit Price (USD)	Total Cost (USD)
Fingerlings and Feeds				
Fingerlings	1000		50	
Starter 2	10kg		17	
Starter 3	10kg		17	
Juvenile 1	25kg		30.5	
Juvenile 2	25kg		25	
Grower	25kg		21.5	
Coarse Salt (NaCl)	50kg		15	
Subtotal				
Pond Material				
110mm PVC Pipes Class 6	6m		39	
110 mm PVC bends (elbow)	piece		8	
Dam liner (250 microns)	square meters		0.9	
Bird Net	25m*5.2m		166	
Subtotal				
Labour & Transport				
Pond Construction	mandays		5	
Harvesting and Packaging	mandays		5	
TLB hiring	hourly		65	
Subtotal				
Total Variable Costs				

Notes:

- Yield shall be calculated based on an 85% fish survival rate.
- Fish is to be harvested at 7 months of age.

Other Essential Budgets

Budget Type	Description
Partial Budget	To assess changes (e.g., new feed type, increased density)
Capital Budget	To evaluate long-term investments (e.g., cage system)
Break-even Analysis	To determine the minimum viable output
Sensitivity Analysis	To test scenarios (feed price hikes, mortality shocks)

Sustainable Production and Marketing Plans

1. Sustainable Production Tips:

- Stock fingerlings from certified hatcheries (to avoid stunted fish)
- Practice polyculture (for example, tilapia + catfish) to diversify risk
- Integrate ponds with manure from goats or poultry for natural productivity
- Use local feed ingredients (for instance, maize bran, BSFL, cottonseed cake) to cut feed costs

2. Marketing Plan:

- Develop market linkages before harvest (restaurants, schools, urban traders)
- Add value: scale, gut, smoke, or freeze for premium prices
- Form cooperatives or clusters to access bulk buyers and cold chain facilities
- Align harvest cycles with peak demand (e.g., religious holidays, school terms)

Conclusion

Fish farming in Zimbabwe offers a promising agribusiness opportunity with nutritional, environmental, and economic benefits.

Success requires proper planning, financial analysis, and sustainable practices. Key strategies for profitability include preparing budgets, optimising feed and water use, and effective marketing.

With support from policy and financial institutions, Zimbabwe's fish value chain can thrive, contributing to rural development, food security, and youth employment.

About the author: Livestock & Fisheries Scientist

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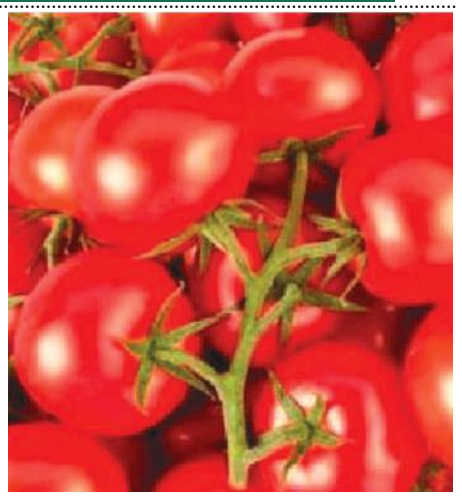


Essential Guidelines for a Bountiful tomato yield

Variety

Growth Habit	Variety
Determinate	Alboran Rodade Roma Floradade Red Khaki Rossol UC82B Heinz Fortune Maker F1
Indeterminate	Money maker Adelaide F1 Thomas F1 Raissa F1 Star 9030 F1

- Tomato characteristics are fruit shape, size, texture, firmness, growth habit, colour, grading quality, taste and end use (cooking, fresh, processing).

Growth Habit:

- **Determinate:** mature at the same time and have to be harvested all at once.
- **Indeterminate:** mature over a period of time, harvested over a period of time.

Fertiliser requirement

Stage	Types	Amount
Basal dress	Seed Fert (7:20:7) or	1 000– 1 500 kg/ ha
	Tobacco Fert (6:18:15)	700 kg/ha
Top dress	Ammonium Nitrate, potassium nitrate after establishment and early fruit bearing stage applied every 21 days	80-100 kg/ha
Manure	Well decomposed manure or compost worked into the soil 4 – 6 weeks before the transplanting	25 – 50 t/ha

Soil pH, Temperatures and Seeding Chart
Soil pH Planting time/temp.

(oC)	Sowing depth (mm)	Seed rate per hectare	Spacing (mm)	Comments		
				Row	In row	
5.0-6.5	Grow well in hot weather if not too wet, in cold weather if there is no frost.	10	250g	900-1500	450-600	Not staked/trellised
			370g	750	230	Canning
			500g	900-1200	300-500	Staked/ trellised
			Sow in seedbed and transplant. 6 -8 weeks after emergence			

Planting
Land preparation:
Nursery bed Preparation

The land is first ploughed with soil turning plough followed by 4-5 ploughings with country plough or harrow. Levelling should be done after ploughing and bring the soil into fine tilth and also provide better drainage facilities At the time of soil preparation, raising the planting bed above ground level facilitates drainage during rainy season.

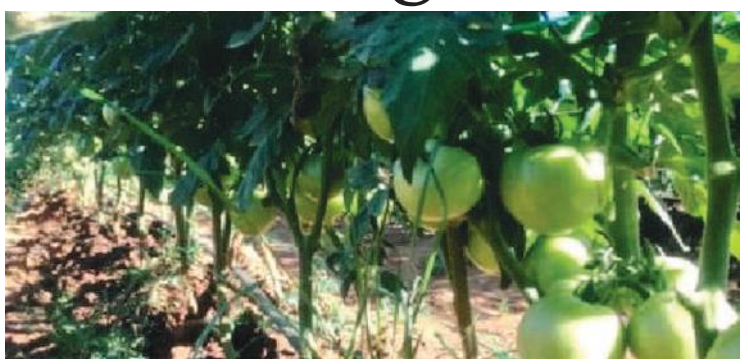
Raising seedling in float trays

Time of planting: Tomato can be grown in any season as it is a day neutral plant. Three crops are taken in areas which are not affected by frost.

Seed treatment: Seed is treated with fungicides like Captan or Thiram 2g/kg of seed.

Mainfield land preparation

Essential guidelines for a bountiful tomato yield



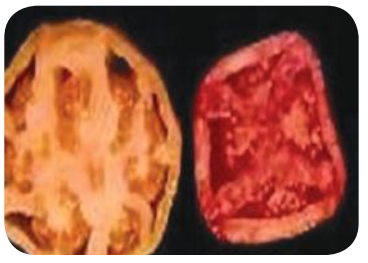
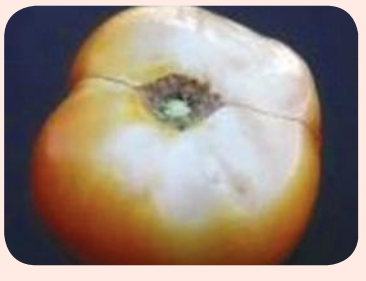
Staking or trellising

Trellised tomatoes

- Support to keep plants upright, preventing contact with the soil and improve air circulation.
- Improve quality for fresh market, increase quantity of marketable produce.

Weeds, Pest and Disease

- Bacterial canker, spot and wilt are controlled by use of healthy seed, rotations, and avoiding water logged areas.

Physiological disorders			
Disorder		Symptom	Control
Blossom end rot	 	Small water-soaked area at the blossom end of fruit, enlarges, becomes sunken and turns black and leathery and sometimes turning the fruit core brown.	Grow resistant cultivars. Foliar applications of calcium chloride at transplanting time can be useful.
Puffiness	 	Fruits appear angular; feels lighter than it should be and holes in the flesh when cut.	Apply sound nutrients.
Sunscald		White/light tan fruit discoloration due to exposure to sun.	Care not to overexpose fruits to the sun, when pruning and harvesting.
Concentric/ radial fruit cracking	 	Circular, concentric cracks around the stem end of the fruit/ fruit cracks radiate from the blossom end.	Use cultivars which are tolerant to cracking such as Floradade and Rodade.

Harvesting

- Pale blossom-end stage: cream-coloured streaks at the blossom-end, sufficient jelly formation around the seed such that a sharp knife will not cut the seeds, can be safely stored for a week or more.
- Pink blossom-end stage: Pink dull red colour at blossom end, can be stored for about four days.
- Pink stage: fruit is almost fully ripe, completely ripe within a day or two.
- Ripe stage—the fruit is virtually ripe but still firm, must be marketed immediately after harvesting.
- Yields
- 20-60 t/ha, or up to 100t/ha with high management level and high potential yield cultivars.

Storage

- Store for 7 — 10 days at 50C to 100C and humidity of 80 to 85% when ripe.
- Can be harvested at the mature green stage to increase shelf life.

Marketing

- Local markets as fresh or dried and to processors, export market.
- Grading and packaging are important for fresh market.

MINISTRY OF LANDS, AGRICULTURE, FISHERIES, WATER AND RURAL DEVELOPMENT

Field and Horticulture Crops Handbook for Farmers