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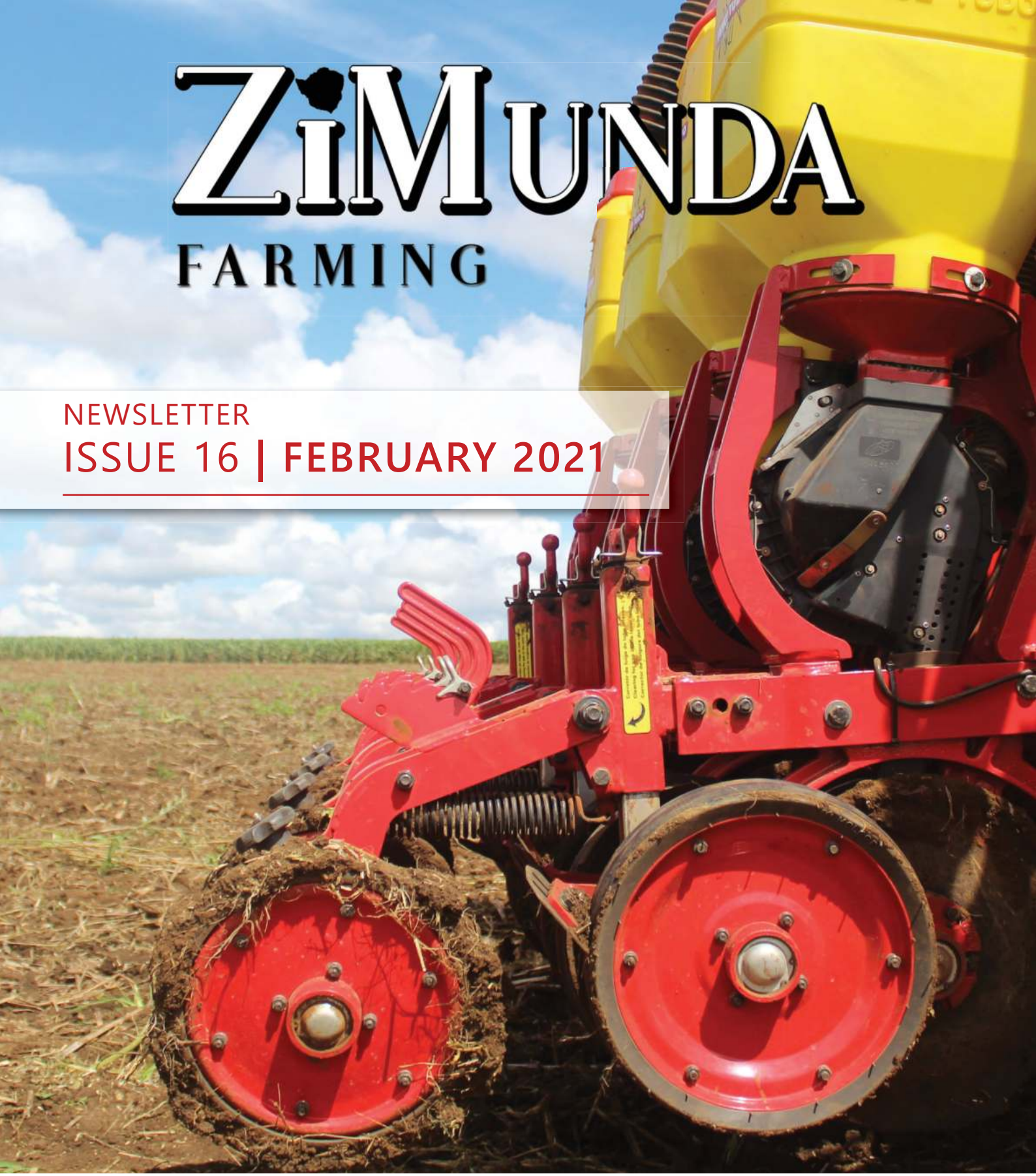

AGRONOMY

INTEGRATED PEST MANAGEMENT

EDAPHOLOGY

THE IMPORTANCE OF FUNGI IN SOIL

LIVESTOCK

HYDROPONIC FODDER PRODUCTION

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Hydroponic Fodder Production

BY DAVIDZO CHIZHENGENI, KVD LIVESTOCK CONSULTANCY

Hydroponics is a system of growing crops without the use of soil. This is done by directly 'feeding' the plants with water that not only ensures the germination and growth of quality crops but also greatly increases the time at which they germinate.

THE BENEFITS OF HYDROPONICS IN FODDER PRODUCTION

- Feed grown in hydroponics presents *fast growth*. For example, barley, the most preferred hydroponic feed grain crop has been shown to grow to a height of up to 15cm in 7 days as compared to the 21 days required to attain the same size via the paddocking system. One kilogram of barley seeds can produce 4.5 - 6kg of fodder in 7 days.

- The *nutritional value* of hydroponic feed fodder is also unmatched as the fodder is rich in protein, B-carotene, trace elements and enzymes. Barley has a higher protein value (as much as 23%) as compared to other grains with a record high of 12- 19%, grown under the same system.

- Hydroponics favours the *economic use of water*; 1 to 1.2 litres of water can produce 1kg of fodder as compared to 80 to 90 litres of water that is required to irrigate soil sufficiently. The water can be reused for other purposes as watering other plants.

- As the feed crops are grown in a sterile, clean, and controlled environment it is free from external factors such as drought, weeds, and pests. This results in *low management time and costs of pests, weeds and diseases*. Catering of a hydroponic system is very convenient as it only requires an average of 3hrs of light labour a day for 5 metres long 3 metres wide system

- This system can *use very small parcels of land*. A hydroponic shelter measuring 5m long by 3m wide can produce 240kgs of fodder for cattle every day. Hydroponic fodder production is a blessing for farmers whose soil is rocky and infertile. It is also a viable farmer-friendly alternative technology to landless farmers for fodder production.

- Hydroponics *ensures constant feed* supply as it is very predictable and it is up to the farmer to decide the exact amount of product, precise to the kilogram he wants to produce on the farm.

The use of hydroponic fodder in different animal production systems present several different specific advantages;

In cattle - Studies indicate that there is an increase in the butterfat content of milk i.e., a 14% increase in cows on a diet of this fodder of barley seeds and 21.42% minimum increase in milk production over non-dairy cows. Hydroponic fodder promotes appetite, and cows tend to come on heat quicker.

In pigs - A reduced fat content of the subcutaneous layer from the normal 14mm to 7mm thus improving the meat quality, and consequently, its market price. As in cattle, sows come to heat quicker.

In poultry - An increased growth rate resulting in a decrease in production costs per kilogram of chicken.

For more information on hydroponic feed production, contact KVD consultancy on 0784458565 or email, davidzochizhengeni@gmail.com

Backlink For more information on growing crops in water solutions, refer to *ZiMunda Farming Newsletter Issue 7* - Hydroponic Farming Featuring 160 Hydro Farm by Vimbai Ruvengo.

Images provided by Davidzo Chizhengeni

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Use of Solar Power in Farms

BY MICHAEL LABAN

A well-known advantage you have in Zimbabwe when using solar power is that there are over 300 sunny days a year - an abundance of power to be harvested for use!

As most farming operations take place during the day, batteries and power storage which are often 80 per cent of a solar system cost are needed less. Thus, reducing costs. The most prominent use of solar power in farms is for irrigation. When setting up a solar system there are a few factors to consider and these are done through an energy audit.

ENERGY AUDIT

An energy audit is the first thing to do. It is established by answering the questions; *"What do you want to power and how much power will the equipment take?"*. Be sure to include all the equipment that will need to be powered. You would not want an incident of omitting a vital 200W appliance, which would cause your whole scheme to fail. Below are three examples of a series of questions one needs to answer in order to make the correct audit.

An example of an intensive solar system for a high-powered farm

In irrigation - The amount of solar power needed is determined by the type of irrigation, its scale, and the water source. For instance, sprinkler/spray irrigation will use more power than drip irrigation, and pumping water from a hundred-meter-deep borehole will take a lot more power than sourcing it from a surface dam or rainwater harvesting scheme. The formula for rainwater harvesting is 1 litre of water for every millimetre of rain on every square meter of collection surface. For example, in Harare with a rainfall of 500mm/yr, I can collect 18,000 litres of rainwater from half of the roof of my garden flat (36 m²). A friend who collects from his tennis court measuring 264 m², harvests 132,000 litres of water. Once the water is collected, the following questions arise; how much area can you irrigate and how do you store the water? If you can lift the water using a simple 1 horsepower pump (756 W) to a 3 m high tank, one could drip irrigate, which is cheaper than spray irrigation. A small, inexpensive, solar system could easily give you 750W during the day to run that pump.

In dairy farming - Most of the equipment in dairy farming needs sterilisation using hot to boiling water, autoclaves, and other kinds of sterilising equipment. The question is, how much power do they use and how much of this can be done in the daylight? Since fresh milk requires refrigeration, a power audit on refrigeration is important, as well as on operational behaviour. For instance, ensuring that the fridge door is never opened after 1600hrs (when the sun is getting poor and energy from the panels is decreasing), turning off the fridges all night, or delivering milk to the collection depots before the day end. These operational behaviours play a significant role in the amount of solar energy needed.

In mushroom farming - If one is growing mushrooms, the equipment needs to be sterilised between crops. This can always be done during the day when energy levels are high. However, mushrooms also require stable temperatures; heat overnight in the winter and cooling in summer (powered by daylight).

THE BASIC COMPONENTS OF A SOLAR SYSTEM

A solar system has three main parts; panels, inverter, and batteries. With these come some minor connecting, mounting, and controlling parts. There is a vast market to choose a solar system from and it is important to consult reputable companies. This way one will receive accurate professional advice on the right investment.

IS IT POSSIBLE TO RUN A SOLAR SYSTEM WITHOUT BATTERIES?

It is highly possible to run a solar system without connecting to batteries for cost-saving. To do so, many more panels will be needed because electric motors and other appliances with motors 'spike' on start-up, and up to seven times over their stated power requirements (hence, you need batteries as a buffer). This is often for a fraction of a second, but the power has to be there to handle the spike. This is one point

where the batteries come in, and act as a buffer, giving that power at the moment required.

TIPS AND GENERAL INFORMATION

- Batteries should be fully charged by the time the sun goes down; this ensures that the battery life is extended.

- It is important to switch off unnecessary appliances overnight to avoid unnecessarily draining the batteries.

- One should note that all figures given in solar systems are "rules of thumb". That is, generally, there is always leakage. Nothing in theory, is ever the same as anything in practice. When the manufacturer says it is a 300W panel that is based on a laboratory perfection 'test'. In real life, consider yourself to be lucky to get 150 W from it on a sunny day, and 30 W from it on a rainy day.

When you install a solar system, make sure to familiarise with its operation. Teach yourself, your family, and the relevant staff what it can and cannot do. No system is the same, and your environment will be different from the next farm's environment. However, they are all similar, and there are many people out there with a lot of experience in various aspects of solar systems on farms.

Michael Laban is the publisher of the Solar Publication, a regular and saveable monthly module to build knowledge of solar power, build on Zimbabwe's experiences, and the Zimbabwean Solar Industry.

For more information contact Michael, email: mlaban86@gmail.com, or visit https://www.pindula.co.zw/Solar_Publication

Images provided by ZiMunda Farming & Melissa Katunga

Biogas Adaptation

BY VIMBAI RUVENGO

Biogas is a type of biofuel that is naturally produced from the decomposition of organic waste. When organic matter, such as food scraps and animal waste, break down in an anaerobic environment (an environment absent of oxygen) they release a blend of gases, primarily methane and carbon dioxide. The gas can be used for combined heat and power operations, or can simply be turned into electricity using a combustion engine.

USE OF BIOGAS

The gaseous fuel obtained from waste fermentation is of interest in producing energy for electricity, cooking, heating, and biofuels for vehicles. Due to a lack of energy in the rural areas of Zimbabwe combined with a surplus of animal manure, biogas digesters are becoming very popular, useful, and even life-changing. These small-scale biogas systems are typically used for digesting animal waste. The resulting biogas can be used in several ways including gas, electricity, and heat. In very large-scale biogas systems such as those in Sweden, hundreds of cars and buses run on refined biogas. The biogas is produced primarily from sewage treatment plants and landfills.

Biogas digester used for space heating in pig houses at the Pig Industry Board

ADAPTATION OF BIOGAS USE IN ZIMBABWE

The study carried out by J. Kaifa and W. Parawira, 2019 (A Study of the Current State of Biogas Production in Zimbabwe) revealed that there were around 711 biogas plants in the country in 2017. These include 650 household plants, 48 institutional plants and 13 municipal plants. Around 90% of the plant's owners were using cow dung as the substrate, 8% were using sewage, 1% was using pig manure and 1% co-digested jatropha seed cake and cow dung.

USE OF DIGESTATE

Bio-slurry (digestate) can be used as a fertiliser to improve productivity in farms and vegetable gardens. Biogas plants owners that use cow dung, pig manure, and chicken manure are more inclined to use the bio-slurry as compared to the plants that use sewage as the substrate.

As a clean source of energy and a renewable means of treating organic waste, biogas is applicable in households, small-scale and large-scale farms.

Image provided by Melissa Katunga

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JOHN DEERE

Soil Amelioration

The Effective Way

BY DAMARA BIO-AGRI

Soils in nature are composed of delicate ecosystems, that function in equilibrium. However, farming these soils disrupts this equilibrium. As a result, the composition of soil has arguably become the most important element to understand and get right when farming to achieve high yielding crops from season to season.

WHAT IS SOIL AMELIORATION?

Once a soil has been disturbed because of conventional farming practices, the process of soil amelioration becomes necessary to sustain a healthy soil capable of supporting healthy crops. Soil amelioration can be defined as the process of modifying soils to decrease deficiencies and improve other soil aspects such as soil aggregation, porosity, permeability, drainage, and rooting depth as well as water, and nutrient holding capacity.

"HOW CAN ONE IMPLEMENT SOIL AMELIORATION PRACTICES?"

At Damara Bio-Agri we offer a set of advanced sampling services, including soil, leaf, and water analysis. The results are evaluated and used to determine fertiliser recommendations specific to each sample taken. Based on parameters such as soil pH and calcium to magnesium rations, recommendations are made. As such, it is important to understand that maintaining the correct soil pH level for your crop is vital because soils that are too acidic result in excessive fertiliser wastage, where as much as 71% of your fertiliser is wasted on a soil with a pH below 4.5.

Above: *MicroGyp Granules*

Left: *MicroGyp being spread*

SOIL pH

To ameliorate soil pH, and if needed to balance calcium and magnesium ratios, Damara Bio-Agri supplies MicroCal (Calcitic Lime) and MicroDol (Dolomitic Lime). Our products are all "Micro"-nised, which means that these products are ground to an ultrafine powder and are then bound with an organic lignosulfonate which aids in limiting calcium lock-up. Once the lime has been granulated, due to the nature of the product and the fine powdered material, it will dissolve at a faster rate and absorb into the soil more efficiently and effectively over a sustained period. Accurate applications are also a benefit of our granulated micronised products, allowing you to treat your soils with the level of precision they require.

MicroCal is an ultra-fine granulated form of pure calcium carbonate that is composed of 35.2% calcium and 0.94% magnesium. It differs from powdered lime in that it is not just a quick fix, rather, MicroCal results in a rapid and sustained pH correction as well as supplying a more available form of calcium to the plant and is thus suited to soils that have low calcium content. With a mean particle size of 2mm, MicroCal has a fast rate of reaction and a high Calcium Carbonate Equivalent (CCE) of 88.46% which positively impacts its effectiveness presenting as a superior alternative to conventional calcitic lime.

MicroDol is an ultrafine calcium magnesium carbonate composed of 27.06% calcium and 7.31% magnesium and is applied for rapid and sustained pH adjustment and/or to supply supplementary magnesium nutritional requirements. With a mean particle size of 2mm, it allows for accurate application and a faster reaction time, improving the Net Present Value (NPV) and ensuring a faster return on investment as compared to conventional dolomitic lime.

MICROGYP

Our last product in the Micro-Range is MicroGyp. MicroGyp is a micronised and granulated form of calcium sulphate, composed of 23.9% calcium and 13.88% sulphate, combined with a 5.5% organic binder that reduces the possibility of phosphate and calcium lock-up. In turn, the calcium will balance the effect of high levels of magnesium in the soil enhancing water penetration and soil aggregation, allowing the movement of nutrients within the soil and to the roots of your crop. With a mean particle size of 2mm this improves efficiency and eliminates over application presenting a cost-effective alternative to conventional gypsum.

For more information on our Micro-Range, please contact +263 (0) 867 700 5277, or email bioagri@damara.org or alternatively visit our website at, www.damarabioagri.com

Images provided by Damara Bio-Agri


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Focus on Soil Fungi & how they Safeguard your Bottom Line

BY LINDSAY CHARTERS - GROW IT YOURSELF

All-around Zimbabwe, various social media platforms such as WhatsApp groups are buzzing with discussions around regenerative agricultural techniques and there have been various documentaries released (e.g. Kiss the Ground and Big Little Farm) recently on the subject. The conversation is picking up momentum as more commercial farmers weigh in with their view on the necessity of soil conservation to safeguard their bottom lines.

When reviewing the design of your crop programs and the various choices for land tillage, crop nutrition, weed and pest control, *it is important to understand what it is that we are trying to conserve in the soil*. The presence of nutrients, whether applied in an organic or chemical form, and the correct pH in the soil is not enough to ensure good nutrition for our crops. The same goes for water: the mere presence of water in the soil and underlying water table does not mean our plants can access it.

SOIL FUNGI AND PLANTS - THE RELATIONSHIP

Plants are adapted to live in relationship with a range of microbes in the soil. One of the most significant of these relationships is the *symbiosis* that forms between mycorrhizal fungi and the root hairs of the vast majority of plants on the planet. These fungi are responsible for recruiting nutrients and water from the soil and channelling them into the roots of the plant. The plant returns the favour by feeding the fungi sugar compounds. Think of it as a massive plumbing system in the soil that carries water and nutrients vast distances, much further and much more efficiently than a plant's roots can manage on their own. Certain mycorrhizal fungi have also been recorded to confer disease resistance on their associated plants.

Mycorrhizal fungi live in symbiosis with plant root hairs, dramatically increasing the assimilation of nutrients, and water into the roots. Their hyphae secrete a white, gluey substance called glomalin which forms web-like structures.

There are many other beneficial fungi in the soil that are also important for the financial viability of your crop. Saprophytic fungi are those that are responsible for breaking down dead plant material and turning it back into nutrients and creating the humus that helps hold the moisture in the soil. Fungi, together with bacteria, are also responsible for making inorganic nutrients (from rock, clay and sand) bioavailable. In simple terms:

Saprophytic fungi are the manufacturers: they release and increase the bioavailability of nutrients while also making the very material that retains your water.

Mycorrhizal fungi are the delivery system: delivering more nutrients and water into your plant roots, across greater distances, than a plant can ever manage on its own. They also make sure less of your fertiliser is wasted.

HOW DOES THIS AFFECT THE BOTTOM LINE ON A COMMERCIAL FARM?

- The establishment of healthy mycorrhizal associations on your crop will mean that the nutrients and water in your soil will be channelled into your plants more efficiently and more completely. This means less money wasted through leaching and run-off and increased productivity as a result of better nutrient assimilation.
- Plants will be able to access water from deeper in the soil and will, therefore be much more resistant to drought and less affected by dry spells, leading to increased yields.
- Increasing the presence of saprophytic fungi will help release more of the natural nutrient potential from your soil and will increase water retention, therefore decreasing the need for irrigation.

WHERE DO WE GET THESE FUNGI FROM?

With natural (unhybridized) indigenous plants, the specific species of mycorrhizal fungi they associate with are endemic in the soil. For most of our crop's plants, there are commercially available mixes of mycorrhizal fungi and beneficial bacteria that can be applied at planting. Saprophytic fungi are present naturally in the soil but are often damaged or eradicated by conventional farming practices.

HOW DO WE CHANGE OUR PRACTICES TO PRIORITISE THE FUNGI AND IMPROVE OUR BOTTOM LINES?

• *It all starts with the tillage* - Go as minimum-till as you can, using the most up-to-date equipment possible and follow techniques like planting directly into mown stover from previous crops. Old-fashioned destructive tillage rips up the plumbing system that is supporting your plants. It is like digging up the pipes between your borehole and your house and still expecting water to come out of the taps.

Mushrooms are the fruiting bodies of underground hyphae; they are an indication of good soil health.

• *Do not poison your support system* - Move as quickly as you can to biological or at least, less harmful pesticide and fertiliser products. Ask your supplier about the effect of their products on beneficial fungi and ask whether they have biological alternatives. Most people are aware of the harm done by pesticides but many chemical fertiliser products contain damaging salt and acid compounds that are used to stabilise the fertiliser.

• *Start to question the validity of herbicides* - Do we need them? Herbicides like glyphosate have a disastrous effect on beneficial microbes in the soil. Various studies done on a commercial scale indicate that many plants that have been labelled as "weeds" are ground covers that prevent erosion and leaching and don't rob the crops of as many nutrients as previously supposed. We would argue that the loss of yield caused by herbicides due to inefficient nutrient and water assimilation in the plants is greater than any losses incurred by so-called "weeds" between the rows, especially if the existing ground covers are controlled with zero-till methods such as strimming.

Whichever path you choose, make sure you are part of the conversation and not falling behind.

Images provided by Lindsay Charters

Growing Sugar Beans after Sunn Hemp Green Manure

BY ROB JARVIS

One of the problems of growing summer crops that are not full season is how to prepare the land prior to putting in the crop without being inundated by weeds and how to face a situation where the rainfall has been so good that getting into the land is difficult due to muddy and sticky conditions.

ZERO TILLAGE

Over the last couple of years, the commercial operation at Agricultural Research Trust (ART) farm, has evolved an ecological farming system that gets high yields from seed crops such as sugar beans. However, given the interest in regenerative farming, not only in Zimbabwe but worldwide, ART felt that it needs to look at best practises that fit with the ideas of the progressive farmers who are adopting and adapting their farming systems to *reduce tillage, inputs, and impact on the environment*. ART established that growing a green crop of Sunn Hemp (*Crotalaria*) over the period of December to January before sowing in the beans at the optimum time in February guarantees a good yield, high-quality seed, and a relatively high return.

PLANTING SUGAR BEANS IN A ZERO-TILL SYSTEM

In the past, the Sunn Hemp would have been ploughed, incorporating the greenery below the soil surface and then planting into the seedbed. Instead ART opted for a slashing operation, taking down the greenery to a surface mulch, leaving a small height of the stem protruding above ground. The slashing worked exceptionally well and the loan of a Brazilian Vende Tudo Summer 6040 pneumatic zero-till planter from Radzim enabled a single pass planting and fertilising operation.

THE MONOSEM PLANTER VS THE RADZIM BRAZILIAN VENDE TUDO SUMMER 6040 PNEUMATIC ZERO-TILL PLANTER

In comparison, ART used its Monosem planter on the other half of the field which required a disking operation first to incorporate green matter into the soil to allow the planter to operate. However, prior to disking, the fertiliser and spray herbicide had to be broadcast so that half of the field had a minimum of three passes of the tractor to get the crop in. This was also the time when the Sunn Hemp was coming out of a wet period in January. The ground being very wet was a challenge and we wondered if it would be possible to sow in the crop in at all. At the time of writing, the crop is germinating and it seems that both planting methods will give results.

The pest control crew (birds) on hand to deal with the insect/pests lurking in the greenery during the slashing operation.

The Radzim planter enables adherence to all the principles of regenerative agriculture, resulting in a good surface mulch, living roots in the soil, minimal tractor passes and compaction. All these factors preserve the life and function of the micro-flora and fauna in the soil; therefore, encouraging soil organic growth and the provision of sequester carbon where it will have the greatest long-term effect.

Radzim's Brazilian Vende Tudo Summer 6040 pneumatic zero-till planter

The series of articles to follow in the near future, intend to track this crop right through up to harvesting and report on the costs involved, the effects of the two systems on the soil and crop health. There is no doubt that ART is confident with the zero-till approach option and it is a pleasure to work with the Radzim planter, a machine that can handle the sticky soils, even mid-rainy season.

Backlink - Agroecology is a way of farming that incorporates practices such as zero-till and regenerative farming. Refer to the Agroecological introductory article in *ZiMunda Farming Newsletter Issue 15*.

Images provided by Rob Jarvis

An Overview Integrated Pest and Disease Management (IPM)

BY ANNA BRAZIER, ECOLOGY AND SUSTAINABLE DEVELOPMENT

If you are to ask farmers what their number one challenge is, most will say pests. Pesticides, (including insecticides, herbicides and fungicides) are now seen as a normal part of most farmers tool kit. Although pesticides, made from plant extracts have been used for thousands of years, the widespread manufacture and promotion of pesticides only took off after World War II. Dichlorodiphenyltrichloroethane (DDT) was used extensively by the US military to protect soldiers from insect-borne diseases such as typhus and malaria. When the war ended, the chemical agriculture era began and the use of pesticides and fertilisers is now widespread.

However, the *rise in pesticide-use* has meant a corresponding rise in pest problems and farmers (particularly in developing countries) are resorting to using more expensive, powerful and dangerous chemicals. As far back as 1959, US Entomologist Vernon Stern and his colleagues noticed that aphids could be controlled more effectively if less pesticide was used. This is because pesticides kill natural predators thus helping pests thrive. Another major problem is that pests quickly become resistant (immune) to pesticides meaning that stronger and stronger versions must be developed.

*The negative impact of pesticide*s - Pesticides threaten the environment and the health of farming communities and consumers. Pesticide use is also having serious negative impacts on soil health. Scientists have realised that soil fertility depends on the complex ecosystem of soil life including billions of species of beneficial fungi and bacteria which are annihilated by pesticides, fertilisers and ploughing. As soil fertility declines, crops become weaker, leading to increased pest problems in a vicious cycle. All of this means farmers have to spend more money on chemicals which are less and less effective.

PRINCIPLES AND PRACTICES OF IPM

Integrated pest management (IPM) is a holistic, scientific approach which recognises that trying to eradicate all pests from crop fields is futile and even detrimental. It uses a suite of technologies that farmers can implement. IMP involves the following:

1. *Prevention* - implementing general measures to prevent pest outbreaks. It is usually done by ensuring good cultural practices such as correct site selection, appropriate crop variety selection, correct planting times and spacing, crop rotation and intercropping, excellent soil and water management, and practising excellent hygiene in fields.

2. *Inspection* - gaining a thorough understanding of the agricultural environment including soil type, crop characteristics, climate, surrounding vegetation and existing insects and other animals. This includes scouting for pests' diseases and weeds as well as beneficial pred ators that feed on pest organisms.

Pest scouting and indentification

3. *Identification and analysis* - ensuring that the pest problem is correctly identified, learning about the pest, and selecting the most appropriate management methods.

4. *Implementation of pest management method* - Apart from cultural methods, there are three other types of IPM;

- Biological control - using naturally occurring or introduced beneficial organisms (insects, plants, microorganisms etc.) to control or suppress pest populations.

- Mechanical or physical control - preventing pests from reaching plants by making barriers and traps as well as removing infected plants.

- Chemical control - used only as a last resort when it is clear that pest problems will cause economic damage.

5. *Monitoring and documentation* - regularly recording the impact of the treatments of the pest for future reference.

Pheromone trap method at Luipaardsvlei Farm (maizefields) Chipinge

ACCURATE PEST IDENTIFICATION

Misidentification of pests is a common cause of pest management failure. Luckily, pests and diseases tend to be quite specific in terms of the plant species or families that they prefer to attack and the type of damage that they cause making identification easier. When identifying a farmer needs to note the time of year the pest is attacking, the lifecycle stage (adult or larvae) if it is an insect or if it is a disease, whether it a fungus, bacteria or virus. Agricultural extension officers can help assist farmers to correctly identify pest or diseases.

Sometimes only the damage caused by the pest will be seen and the farmer must be able to recognise the type of damage caused and the part of the crop plant that is usually attacked. For instance, pests can be classified according to their feeding habits;

- Sucking pests (aphids, whitefly, tip-wilters, bagrada bugs)

- Chewing pests (grasshoppers, caterpillars, termites and weevils).

- Other pests such as nematodes, leaf miners and stem borers leave tell-tale patterns on leaves, stems, fruit or roots.

The best way to appraise the extent of pest damage in a crop field is through *scouting*. This means walking through fields weekly in a systematic way, inspecting crops to quantify pest populations and crop damage. Scouting gives information on pest activity and population size. It helps the farmer decide whether chemical control or other control is necessary based on the potential crop loss versus the cost of treatment. Many common pests including aphids and red spider mites can be kept below economic injury levels by maintaining a healthy population of natural predators.

Most agronomists agree that IPM is the most effective, safest, and most economical approach. Unfortunately, it requires the farmer to learn about pest and disease identification and rigorously practice cultural, biological, mechanical and as a last resort chemical management method. This has limited its use. Extension officers could help farmers by producing simple IPM booklets with clear photographs of pest problems and practical solutions.

Backlink – IPM is an advocated practice in Agroecology. For insights on Agroecology, refer to its Introductory Topic in the *ZiMunda Farming Newsletter Issue 14*.

Images provided by David Brazierr & Lorna Joubert

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COVER

Radzim's Brazilian Vende Tudo Summer 6040 pneumatic zero-till planter at ART Farm, photograph by Melissa Katunga.