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Changing the landscape of Broadleaf weeds control in cereals

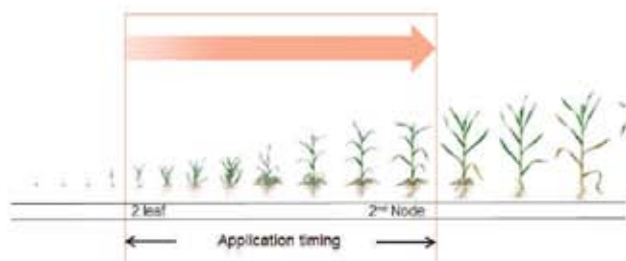


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NOTE

Optimum performance of Huskie occurs when it is applied in warmer temperatures with high light intensity. Avoid application within 1 hour of sunset, or at night, particularly if followed by low overnight temperatures.

Application window



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	Apply only once per season.



Huskie performance on broad leaves and its effect on grass family 7 days after use



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TABLE OF CONTENTS

Editorial

Happy 2022

A Chinese proverb says that in order to gain new insights we need to study the past. This is why I will start by reflecting 2021. 2021 can be labelled as one of the toughest years in our farming history. Our challenges traversed production, human resource to the market.



Based on the above;

First, I firmly believe that solid and consistent policies are the backbone of agricultural and rural development. Kenya needs policies aimed to ensure preserving a viable, economically sound, farm-based sustainable agriculture. This should be combined with encouraging and supporting a diversified rural economy which provides income opportunities both on- and off farm.

Second, the information needs of farmers are increasing as they must take more complex decisions on land use, crop selection, choice of markets and other areas that impact the livelihoods of their families and communities. That's why I always say many times, since ten years ago, mobile phones are a pleasure for people who live in cities but mobile phones are a new farming tool for farmers, for agriculture companies and for agricultural dealers because they can offer you information from the environment, production, processing, and marketing - covering all the production lines, supply chains, and value chains. They are a direct connection between producers and consumers.

Having access to the right information at the right time and in the right form is no longer a luxury, but a necessity. This includes early weather warning and farming advisory services. We need a good foundation, fundamental advisory services in Kenya. So if you transfer quickly from the traditional business model to the digital model, that is your new value-added service.

That is 2022 and the future.

Masila Kanyingi

Editor



Galana/Kulalu Ready for Large-Scale Commercial Production

28

IRRIGATION



Why soil salinisation is a common problem

34

SOIL MANAGEMENT



Drought-tolerant maize project

22

RESEARCH

- 4. Farmer To Farmer Knowledge
- 6. Weed Management
- 12. Wheat farming
- 16. Can We Reduce Fertilizer use?
- 19. Integrated Pest Management
- 29. Buying into New Seed
- 38. The Gender Quest

Cereals

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Farmer To Farmer Knowledge Exchange: Relevance And Challenges During Change

Change is constant, but at this moment the pace and breadth in agriculture is unprecedented. With the biggest change in domestic policy in the UK since the Second World War combined with extreme weather events, trade agreements and global pandemics farming can seem very daunting. As individuals we have to take control and drive our own destiny without waiting to be told.

Encouraging curiosity to seek knowledge is vital whilst being open minded and aware of one's own biases and filters.

Having the confidence to identify strengths and weaknesses under pressure is not easy. Building capacity, capability and social capital to enable resilience needs to happen; farmer to farmer knowledge exchange plays an important part in this.

Information and data provide the building blocks for knowledge. The knowledge created through personal experience; tacit knowledge, is often undervalued by people who possess it but, unless it is shared it will be lost. Knowledge exchange is a two-way process and we can choose whether to use our knowledge for our own benefit or share it for the wider benefit of the industry.

There are a variety of ways in which farmers share knowledge which have evolved with the introduction of social media. Social bonds formed through small groups can be the most effective in creating trusting relationships to drive change and enable what could be deemed sensitive subjects to be discussed. Larger groups and online sharing also provide opportunities if there is trust. Trusted relationships not just between farmers but throughout the wider network are crucial;

farmers are part of the knowledge exchange landscape.

Knowledge exchange goes wider than technical topics; it creates interactions vital for mental health, particularly during the uncertainty of change. Getting people off farms to a local group or simply connecting with another farmer to share 'what's keeping you up at night' is essential to prevent isolation and build mental resilience. You need to be 'optimistic to learn something new'.

Farmers automatically have a connection with other farmers, 'it's the messenger not the message' which facilitates the exchange of knowledge. The memorable examples I saw always had people at the heart who were generous in their sharing, had seized an opportunity and made it happen.

Creating the right environment so that people feel comfortable is often on farm providing the opportunity to 'kick the dirt' and 'seeing is believing'. Facilitators are important to manage group dynamics and draw out knowledge; the answer is often in the room. A balance needs to be struck between comfort and disruption; bringing different sectors together can assist this. The challenges of today are cross sectoral; the industry needs to move away from a sectoral focus to address these. People are complex and trying to apply logic or model how people will react to a particular situation is fraught with difficulties, as has been experienced with Covid-19. We must recognise we hold the future in our hands and

seek the knowledge we need to realise our ambitions.

'Everything is about people, no matter what the subject matter'

The people aspect must be considered when developing policy, strategy or new technical solutions. Without strong social capital





throughout
the industry
we will not
change to meet the
challenges of now and the
future.

The benefits of the fragmented knowledge exchange landscape in the UK in providing a wide range of options to the industry is to be welcomed, but the weakness of this model in creating comfortable echo chambers needs to be recognised. This is a challenge for effective knowledge exchange and collaboration is required; the sum has to be greater than the parts. This means the structure of industry organisations needs to be considered to enable cross sectoral knowledge exchange to address the cross-cutting challenges. This will also create the cohesion that is needed at local level to address the environmental challenges that need landscape scale solutions.

Collaboration must happen between all those involved in the industry - farmers, organisations, the supply chain and government - to create a joint sense of ownership and a culture of trust recognising we all have a role to play, albeit different, in meeting the challenges we face.

Communication through trusted relationships is the only way to join the pieces of the puzzle together and this has to happen to give us the strength to face the inevitable changes that are required. Reaching out to those who do not engage has to be done through trusted relationships and we all have a role in looking out for each other.

The high relevance of farmer to farmer knowledge exchange during change goes without question. The biggest challenge in the UK is not the provision of opportunities for knowledge exchange; it is mind-set. Our own mind-set impacts on who we share knowledge with, what knowledge we share and how receptive we are to accepting knowledge from others, particularly if our personal values are challenged. We all need to reflect on our own mind-set and consider if we are open-minded enough. For those who provide information there is a need to understand that until it has been understood and experienced, it does not become knowledge and for knowledge exchange to be effective everyone's knowledge is valuable.

Given the impact on all businesses of the expected post- Brexit policy and trade changes, everyone needs to consider their own mind-set and how it impacts on their long-term ambitions. What does success look like? What is the journey required to achieve this success? All possibilities, including looking outside the industry for innovation or welcoming new entrants with different skill sets, who are not constrained by their forebears' actions and who can approach issues from different angles, need consideration. We hold the solution and need to recognise this, take control and lead,

standing out from the crowd when required. It is within our gift to share our knowledge for the benefit of others, to drive the changes that are necessary and to have a thriving rather than surviving industry.

Recommendations

To Farmers

There is need to challenge our industry, taking ownership to solve our own problems. We hold the solution; our destiny is in our hands,

Recognise the value of our knowledge; be confident in sharing it and be open minded in receiving it.

Recognise the importance of good mental health to create resilience during change.

To Industry Organisations

Organisational 'politics' needs to be set aside for the benefit of the farming industry. Sectoral approaches exacerbate siloes of knowledge. Collaboration is needed between organisations and across sectors.

We need to drive change through the whole supply chain encouraging people from outside our industry to bring a fresh perspective.

A variety of methods of knowledge exchange is required. People are complex with different values, biases and learning criteria. Taking time to build trust is vital for this.

To Government

Recognise the importance of social capital with and in the farming industry and the wider rural community. Without social capital, delivery of natural capital will not be realised.

Co-creation: End users must be incorporated into policy development and research, building on existing knowledge and creating space for innovation.

Rural connectivity: To enable all opportunities for knowledge exchange to be realised rural connectivity is essential.

Weed Management: Practices For Integrated Solutions

Integrated Weed Management (IWM) is a comprehensive method to control and mitigate infestation in fields incorporating diverse techniques. The oldest way to tackle the problem is manual pulling. Yet, it is labor and time consuming due to vast areas and short staff.

Nowadays, most farmers rely on herbicides. However, sustainable agriculture and organic farming require a profound reconsideration of the approach as chemical residues harm both humans and nature, and many herbs develop resistance to chemical substances. In this regard, alternative and integral weed management plans are the most beneficial option with a thought of the future.



Methods Of Weed Control

Weed management in agricultural fields includes quite many events and tactics that make five main groups. They are as follows.

(1) Preventative Weed Control

This management method aims to avoid contamination of the planting material and cultivated areas. It involves:

- buying high-quality weed-free seeds
- washing equipment
- checking livestock's fur and legs
- screening irrigation waters for weed seed transportation
- use of thoroughly rotten compost and manure to prevent seed germination.

(2) Cultural Weed Control

It ensures field conditions that are less favorable for non-crops to develop. The given management





- burning
- mulching
- covering space between rows (for example, with straw)
- robotic weeding machines
- weed seed destructors
- haymaking before weeds burst with seeds.

(4) Biological Weed Control

It employs plant enemies in their habitats. Thus, sheep, tansy flea beetles, and cinnabar moths destroy tansy ragwort. Grazing is another example of the management technique.

Biological control also includes placing pathogen organisms like bacteria, fungi that attack certain species. They are diverse and damage separate parts (leaves, stems, seeds, roots).

Biological weed management was successfully undertaken in north-east Australia in the early 20th century when the cactoblastis moth battled the prickly pear with other cases to follow.

The timely release of biological agents helps farmers to tackle the issue in a simple and eco-friendly manner as it happens in the natural environment.

However, imposing this management method on areas that are not natural habitats for foreign plants is highly questionable, needs thorough research, and should be applied with care. If populations of biological enemies develop faster than species they destroy, the situation turns into an ecological disaster bringing more harm than benefit. They become pests themselves. Furthermore, biological agents even threaten non-target plant species at times.

(4) Chemical Weed Control

The practice implies an application of industrial chemical products to defeat infestation. Even though this approach gives quick results, it is poisonous and causes harm to organisms and natural resources. Another aspect is resistance and ineffectiveness of herbicides as a consequence. Besides, chemical applications involve cost inputs, especially if used repeatedly. Therefore, it is essential to use herbicides with various modes of action and different mixes. Following label instructions is vital.

A significant constituent of chemical control is the correctly scheduled usage of not only herbicides but fertilizers as well. They are beneficial if applied in the optimal period of plant development.

approach includes:

- planting high-adaptive and competitive species
- selecting big seeds that are likely to produce strong and vibrant plants
- crop rotation
- field fallowing
- use of cover crops
- reduction of space between rows
- shallow seeding (thus, crops can grow faster than other herbs)
- planting local species that adapt to the natural environment and compete with weeds easier.

(3) Mechanical Weed Control

This management technique suggests destroying unwanted plants with farming equipment or manually. This aspect of management utilizes:

- ploughing
- tilling
- mowing
- manual pulling (hand removal)

MAIN STORY

From Page 7

Weed Identification as a Part of Weed Management Plan

Satellite imagery helps to detect herbal intrusion on various stages of yield production in the fields. It is possible with vegetation indices that allow farmers to notice the problem early and react timely. When satellite charts show weed presence, the next steps are scouting and elaborating balanced weed management solutions.

However, not only fields proper require inspections. Unwanted seeds penetrate with wind and water from fencerows, irrigation ditches, and non-crop terrains, so these zones must be checked and treated as well.



Before Seeding Period

Prior to sowing, one can trace weeds after plowing, depending on if the soil is bare or covered (recently plowed fields are supposed to have no vegetation).

When there are no crops seeded yet, but vegetation is detected, it means these plants are non-crops. The conclusion enables agrarians to make correct management decisions.

Early Season

To detect weeds at the beginning stages of plant growth is rather hard because they are small, and the soil reflectance dominates.

Crop Monitoring can help to monitor this phenomenon on MSAVI charts that are important for weed management solutions.

Late Season

When crops mature, weed identification becomes simpler. Remote sensing can distinguish drying and withering crops that lose chlorophyll (and thus green coloring) from weeds that are still green. Fading



plants acquire yellow and brownish hues.

Weed Scouting in Weed Control

Management

When vegetation indices report on critical areas suggesting weed presence, scouting should augment monitoring to confirm infestation or find out another actual issue of deviance in plant growth.

Yet, it is not

impossible. When vegetation indices signal about discrepancies in development (either insufficient or excessive), the cause of the anomaly may be weed infestation. Typically, weeds are stronger than crops and develop faster, taking nutrients off the soil and hiding crops from the sunlight.

Field scouting can be carried out either by driving to the field, with drones, or with specific scouting apps in agricultural software.

Managing the Chemical Weed Control Effectively

Herbicides are never 100% safe for humans, crops, and soils. Therefore, their applications should be wise and sparing. Major factors enhancing or reducing

herbicide efficiency include:

- growth stages
- climatic peculiarities of the area
- weed resistance
- application volumes and density
- retention on leaves
- breakdown by light
- soil content and composition
- methods of application
- rainfalls
- relative air humidity
- air temperature.

Herbicide types and conditions of their usages are critical in agricultural management.

Thus, chemicals lose efficacy when

absorbed poorly or washed off from the target plants and areas. Some herbicides are activated only in dry weather when they remain on the soil or plants for a determined period of time. Other herbicide types gain efficiency only after rainfalls or irrigation. Besides, herbicides can burn crops and destroy yields if used in hot weather. Inaccurate time causes repeated applications as a consequence.

Apps with weather precipitation are helpful in this regard, as forecasts are essential to avoid washing chemicals due to rainfalls or their applications on the wrong territories because of winds. Even though herbicides seem to be the fastest (and the most widely used) solution, repeated or incorrect usage reduces their efficiency.

The Crop Monitoring app gives

comprehensive weather precipitation data facilitating management activities. It helps to monitor air temperature, relative humidity, wind speed, and direction. The application also alerts on upcoming rainfalls, equipping farmers with precious knowledge on how to schedule weed control events.

Another important feature of Crop

Monitoring is field zoning. Different zones with different vegetation density require different management. Correspondingly, herbicide volumes should vary depending on the concentration of weeds. By mastering the situation, agrarians can avoid wastes of chemicals and eliminate their harm to crops and natural resources.

When Used In Complex: Integrated Weed Management (IWM)

The advantage of IWM is that it combines different methods of weed control used in agriculture, making the best of the situation. The approach helps to find the most effective and environment-friendly options and avoid unjustified chemical usage. Apart from the harm herbicides cause to nature, crops, and humans, weeds tend to develop resistance to them. Thus, even repeated usage of poisonous substances becomes a waste and danger.

It is essential for sustainable agriculture and is possible with the following management techniques utilized in turns:

- Taking preventive actions
- Crop rotation (different species, especially

with various seasons of growth)

- Fallowing
- Weed identification and scouting
- Checking weather forecasts
- Cover crops
- Grazing
- Timely and wise chemical applications
- Correct nutrient distribution.

The integration of these techniques reduces cost inputs and boosts yields. When used in complex, different tactics enhance each other's benefits and decrease negative impacts. For example, crop rotation helps to remove certain weeds from terrains if they do not co-exist with a new culture species. The presence of natural enemies restrains weed growth. Grazing livestock destroys unwanted plants in pre-seeding or post-harvesting periods. The cleaning of equipment hinders seed spreading.

Cover crops and quality weed-free seeds decrease the necessity of herbicide applications, too. These cases illustrate how cultural, biological, preventative, and chemical types of control work together. Combinations of various tactics and elaboration of weed management plans prove to be the most advantageous approach. They should be cost-effective, efficient (with the least adaptation), and considering the impact on humans and nature.

A good weed control plan for agricultural purposes does not spoil the quality of soil and crops. It includes not only the specific herb to tackle but time and methods to manage the infestation.

Thus, integrated weed management is the most beneficial option in the long-term perspective. It helps achieve economic and ecological goals with the least efforts and harms offering a solution even in the case when some techniques are not suitable.





Wheat farming: Costs and profits per acre in Kenya

Farmers in Kenya are very enterprising and hardworking people. This explains why there are numerous different projects that people are willing to try out.

Wheat farming in Kenya is one of the most lucrative farming ventures that any farmer can undertake especially if they have large tracks of land. The following is a guide on how you can engage in wheat farming and make profits out of it. After all, wheat is the second cereal crop that is most consumed in Kenya after maize. Its economic significance can therefore not be ignored. With proper management, it is possible to reap great benefits from the wheat farming business in Kenya.

Understanding wheat production in Kenya per acre

For optimal production, you need to understand the conditions that promote growth. Those doing large scale wheat farming in Kenya have understood what it takes to be a success.

Favourable wheat growing conditions in Kenya

Gently **sloping land** that allows for mechanization. Wheat requires a lot of machine farming to be successful

- The **right altitude** for growing wheat ranges from 1500 -2900mm. This is a perfect altitude especially because it helps in disease reduction
- Wheat requires **moderate rainfall** which should be from 500mm to 1270mm.
- The temperatures should be between 15 degrees to 20 degrees especially for the first three months which will promote growth and maturity.
- The soils that support wheat farming are deep **volcanic soils** that are well drained
- After the first three months, wheat require dry, **sunny spells** that will promote ripening and harvesting



Wheat and barley farming in Kenya has grown because of the demand for these products. Companies are always on the lookout for farmers that have the products in bulk, therefore, the market will not be an issue. In fact, for wheat, the government buys from its farmers at a reasonable price

Understanding the cost of wheat farming in Kenya

The fact that you are doing wheat farming as a commercial farmer means that you must put into consideration all the production costs involved from the time you plant harvesting. It is crucial therefore to know how much you will need to make this project a success. You have to buy inputs and will incur other expenses. If you are leasing land, start your calculation from the costs of leasing land which would be about Ksh.3200 in a wheat growing area such as Narok. Ploughing cost would be Ksh.1500 an acre, Ksh.1200 for harrowing, Ksh.2000 fertilizer, Ksh.3000 for chemicals, and Ksh.1500 for harvesting costs.

Planning for such costs would work excellently for you. You do not have to worry about harvesting fees because this will be paid by the companies coming to buy the wheat while still on the farm. Wheat and barley farming in Kenya has grown because of the demand for these products. Companies are always on the lookout for farmers that have the products in bulk, therefore, the market will not be an issue. In fact, for wheat, the government buys from its farmers at a reasonable price per bag with last season going at Ksh.3400 per 90kg bag. With an estimate of 12 bags per acre, a farmer is able to calculate their potential profits before they can even decide to invest in this type of farming.

Challenges in wheat farming

There are certain problems facing wheat farming in Kenya just as is the case with other crops. The questions on how profitable is wheat farming in Kenya can only be answered after understanding the cost of the challenges and deciding if it is worth it. Wheat has a number of challenges including the following.

Climatic challenges

It can be a major issue when droughts set in at the time when the crop is still at the maturing stage. This is because wheat requires well-distributed rain to mature. Things can also go south very fast when dry season is needed for ripening and harvesting, and instead, heavy rain falls.

Pests and diseases

This is probably the major problem when climatic conditions do not disappoint. Farmers need to be well prepared with herbicides to curb any problem that could arise from attacks by pests and diseases. You need to constantly talk to agronomist and other

experts to ensure that you have the right pesticides for your wheat at every stage

Costly storage even after harvesting

Sometimes farmers are forced to sell their wheat at a throwaway price because they lack sufficient storage.

Wheat farming is a very lucrative venture for Kenyan farmers, especially because there is enough demand for wheat both in the domestic market and also for export. If there is a way of curbing the challenges that farmers face and addressing the issues that affect production, then there is a chance that farmers could earn even more from this kind of farming.

Wheat farming can be very fruitful especially when done on a large scale because you are able to cut down on cost. With the support that the government is giving farmers for the same, this appears to be a line of farming that those in favorable climatic regions should consider seriously.



Wheat Farming: Production and Maintenance of Quality Seed

By Macharia G., Rukwaro G.

Seed is a primary input in crop production. For seed to play a catalytic role in crop production, it should be accessed by farmers in good quality and quantity. Good quality seed can be defined as seed of an adaptive variety with high varietal species and physical purity, high germination and vigour. The seed should be free from seed-borne pests and diseases and clean, treated and clearly labelled.

The availability, access to and use of quality seed of adaptable wheat varieties are important considerations in increasing wheat production and productivity. Seed quality comprises of many aspects, but four key attributes may be identified:

Genetic quality, which is the inherent genetic make-up of the variety contained in the seed, which provides potential for higher yield, better grain quality and better tolerance to abiotic and biotic stresses.

Physiological quality, which is the viability, germination and subsequent seedling emergence in the field.

Physical quality, which includes freedom from impurity (that is freedom from other crops as well as common and particularly harmful and parasitic weed seeds); seed size; seed weight; and seed lot uniformity.

Health quality, which includes the absence of infection or infestation with seed borne diseases and pests.

Seed maintenance and multiplication

The purpose of seed maintenance is to produce new lots of breeder seed with the same genetic composition. It is the task of breeder to maintain the variety once it has been released. For wheat, plants representing the variety are grown in ear-rows and carefully observed. Plants from selected rows are harvested and grown in small plots; row-plots. Breeder seed is

produced from plots with the best wheat crop and highest crop purity. The initial small amount of breeder seed is initially multiplied to produce basic seed which is further multiplied to large quantities of certified seed or commercial seed to satisfy farmers' requirements.

Steps in Production of Quality Seed

1. Selection of adapted varieties

The variety is selected from a list of recommended varieties.



Apart from its adaptation, the variety should have high yield potential, tolerance to abiotic and biotic stresses and have good marketability and consumers preferences.

2. Selection of seed source

After selecting the variety, the seed for planting should be chosen from a good source. Good quality seed comes from a known source such as from the plant breeder at the agricultural research centre who provide Breeder seed. This class and subsequent classes of seed assures high

varietal purity and germinability.

3. Selection of production field

The amount of Breeder seed normally used for seed production is of small quantity and hence has to be “increased” in large production fields to achieve the large amounts of “certified” seed that is required by farmers for commercial wheat production. Fields selected to ensure high quality seed production should have the right previous cropping history known to avoid genetic, mechanical and pathological

contamination in seed production. Land selected for seed production should be free from varieties of the same crop species for at least one year prior to planting.

In wheat seed production, other cereal crops such as oats, barley or rye should be avoided since it will be very difficult to purify by rouging if contaminated with these cereals. The field for seed production should also be free of harmful weeds and seed/soil borne diseases.

4. Land and seedbed preparation

Proper and timely tillage preparations are necessary to improve the soil moisture conservation and physical properties. It also reduces weed and volunteer plant population, reduces disease and pest inocula; and enhances germination, emergence and establishment.

5. Sowing date, sowing rate and method

The time of sowing depends on the variety and area of adaptation. A seed crop must be planted at its recommended time. Late planting is not recommended. The optimum seed rates may vary with crop, variety, location and method of planting. The recommended seed rate should be used when a crop is sown at normal time to achieve the right plant population for adequate competition with weeds and for better yields.

6. Weed control

In seed production, contamination of the seed crop with other crops or weed seeds of similar physical characteristics must be reduced to the minimum.

7. Harvesting and Transporting seed

It is critical that harvesting is done when the crop to dry enough and to avoid rainy days.



To Page 14

“ Good quality seed can be defined as seed of an adaptive variety with high varietal species and physical purity, high germination and vigour. ”

CROP PRODUCTION

From Page 13

Harvesting machinery should be thoroughly cleaned and checked for any potential contaminants. Moreover, harvested material should be placed in appropriate clean bags, labelled accordingly and immediately transported to the processing yard to avoid deterioration.

Transporting seed should ideally be done in water-proof but well aerated containers, and preferably seed for each variety transported separately to minimize unnecessary mixing.

8. Seed processing

Seed requires processing; the seed is dried, cleaned, graded, sized, treated with pesticides and finally packaged. Seed processing is the most capital intensive because it involves the use of various sophisticated equipment and often expensive seed dressing chemicals.

Seed quality control

The Kenya Plant Health Inspectorate Services (KEPHIS) inspects the seed crop at most stages to ensure high quality seed. Seed quality parameters includes purity, germination, health, weed

seed content, moisture content, and characteristics.

Seed certification

Seed certification ensures that the seed sold to farmers conforms to the indicated variety. It should also be sufficiently pure, of good germination capacity and disease free.

Seed certification involves the following steps:

Field inspections - to verify seed source, varietal identity, previous cropping, isolation distance, impurities and diseases. It is done by an inspector from KEPHIS during the various stages of growth of the crop.

Seed inspection - done at the processing plant and in the seed store. Seed samples are taken and tested at the seed testing laboratory.

Pre-control and post control plots - these are carried out by the seed certification agency (KEPHIS) on its farm to allow further verification of varietal identity, varietal purity, and absence of seed borne diseases. Precontrol plots are grown in the same season as the seed crop and results are used for certification. Post-control plots are grown from seed that is already certified and function as checks on the effectiveness of field inspection.



The Kenya Agricultural and Livestock Research Organization has developed bread wheat varieties (hereafter wheat varieties) for various stresses and quality in a period spanning over 85 years. During this period, 180 wheat varieties have been released to farmers for use. The goal has been to contribute to enhanced food security as well as economic development at the farm, community, and national levels. Through strategic partnerships, the goal of the wheat breeding programme extends to regional and global frontiers.



Can We Reduce Fertilizer use Without Sacrificing Food production?

Fertilizers help us to achieve higher crop yields. This is an obvious net positive for humans: farmers can produce and earn more, and the world has more food.

Summary

Fertilizers can increase crop yields. This not only offers important benefits for farmer incomes and food security, but also produces environmental benefits by reducing our demands for farmland. Many countries would benefit from using more fertilizer.

When they're over-applied, they can also become an environmental pollutant. We might assume that there is nothing we can do: that to achieve higher yields we need more inputs and therefore necessarily cause more pollution. But the research shows that this is not necessarily true. Farmers in many countries can reduce fertilizer use without sacrificing food production.

One of the world's biggest and most impressive studies shows us that simple interventions can produce large results. In a decade-long trial, researchers worked with 21 million smallholder farmers across China to see if they could increase crop yields while also reducing the environmental impacts of farming. They were successful.

In the decade from 2005 to 2015, average yields of maize, rice and wheat increased by around 11%. At the same time, nitrogen fertilizer use decreased by around one-sixth. By producing more crops and needing less fertilizer, this experiment provided an economic return of US\$12.2 billion. This wasn't achieved through major technological innovations or policy changes: it involved educating and training farmers on good management practices.

It's often assumed that fertilizer use – alongside the pollution it creates – and crop yields present an inevitable trade-off. To increase yields, you need more and more fertilizer. This large-scale study suggests this trade-off is not always as extreme as we might think.

[To Page 16](#)

From Page 15

To be clear: fertilizers are vital for global food production. There are few innovations that have transformed the world as much as synthetic nitrogen.

For most of human history, food production was limited by the amount of reactive nutrients that were available for crops. This all changed with Fritz Haber and Carl Bosch. Rather than relying on the scarce nitrogen that exists naturally within the world's soils, we could produce our own. Their innovation (the Haber-Bosch process) at the beginning of the 20th century enabled the lives of billions of people. Estimates suggest that every second person reading this has them to thank for being alive today.

Fertilizers help us to achieve higher crop yields. This is an obvious net positive for humans: farmers can produce and earn more, and the world has more food. What's less obvious is that this has a large environmental benefit. Higher crop yields mean we need to use less land for farming. This means we can protect forests and maintain natural habitats.

But it's true that alongside the environmental benefits, there are also some downsides. Not all of the nitrogen we use is used by the crops. The rest runs off the soils and into the natural environment: fertilizing the rivers and lakes and thereby upsetting the balance of ecosystems and causing biodiversity loss.

We might assume that there is nothing we can do: that to achieve higher yields we need more inputs and therefore necessarily cause more pollution.



Nitrogen use efficiency:

balancing yields and the need for nutrient inputs

Using lots of fertilizer wouldn't necessarily be a bad thing if all of it was used by the crops. Unfortunately, most of it isn't.

To capture this, we can look at the ratio of nitrogen in harvested products (our crops) compared to our inputs (fertilizers or manure); this ratio is called the 'nitrogen use efficiency' (NUE). A NUE of 60% would mean that the amount of nitrogen in our crops was 60% of the nitrogen that was added to them as inputs. The remaining 40% of nitrogen was not used by the crops.

A low NUE is bad. This means very little of the nitrogen we add is taken up by the crops. A NUE of 20% would mean that 80% of the applied nitrogen became a pollutant.

Some countries have a very high NUE – greater than 100%. You might assume that this is good news. In fact, it's often the opposite. This means they are undersupplying nitrogen, but continue to try to grow more and more crops. Instead of

utilizing readily available nutrients, crops have to take nitrogen from the soil – a process called 'nitrogen mining'. Over time this depletes soils of their nutrients which will be bad for crop production in the long-run.

Globally, NUE has been stubbornly low, at 40% to 50% since 1980. This is surprisingly low. It means that less than half of the nitrogen we apply to our crops is actually taken up by them. The rest is excess that leaks into the natural environment.

But there are very large differences in NUE across the world, as shown in the map. Some countries achieve low NUE – less than 40%. Both India and China, for

example, have an efficiency of only one-third. Some countries, though, do much better. France, Ireland, the UK, and the US, have an efficiency greater than two-thirds.

How nitrogen use efficiency has changed over time

We can reduce nitrogen pollution without a decline in yields

So, nitrogen efficiency rather than just fertilizer use seems like a better sustainably metric for us to benchmark.



We might assume that all countries could achieve the same high NUE. But, maybe it's still unfair to compare countries across the world in this way. Differences in climate, vegetation, and soil types mean we can't achieve the same yields with the same inputs everywhere. Some countries might have more favourable environmental conditions than others.

How can we better understand which countries are doing well in these yield-fertilizer trade-offs?

An interesting way to tackle this question is to look at the discontinuities of yields and nitrogen pollution at international borders. This is the approach that David Wuepper and his colleagues took in a recent study, published in Nature. By looking at the discontinuities of yields, nitrogen balances and inputs across borders the researchers investigated the role that each country's agricultural policies play. This is because

the environmental conditions, climate and soil qualities should be very similar just across the border. Technically they should be able to achieve a similar level of NUE, and similar yields. If there are large differences in yields or pollution between one country and its neighbour, we would therefore assume there are important country-specific effects playing a role. It

mimics a 'natural experiment' where the environmental conditions are held constant, and policy decisions are the changeable variable.

Across this large global dataset, researchers have found that the discontinuity in nitrogen pollution across borders was much larger than the discontinuity in yield gaps. Their results suggest that globally there is massive potential to reduce nitrogen pollution without impacting crop yields.

They conclude that nitrogen pollution could be reduced by around 35% if polluting countries became as efficient as their neighbours. This would have little impact on crop yields – increasing yield gaps by only 1%.

There are a couple of important points we need to keep in mind. All of these values are measured relative to a country's neighbours. A country might have a good score because their neighbour gets very low yields. Or a country scores well because its neighbour uses nitrogen inefficiently.

These are the countries that are over-applying nitrogen the most: they could probably reduce fertilizer use significantly without affecting their crop yields.

How can we use nitrogen more efficiently?

Most of the largest polluters are middle-income countries. During the 1960s and 1970s, many of today's middle-income countries kick started their 'Green Revolution' and achieved large increases in food production. Governments offered subsidies for farmers to use fertilizers and

[To Page 18](#)

From Page 17

other inputs. This made fertilizers cheap and reduced the incentives for farmers to use it efficiently. This cheap fertilizer is one of the reasons that these countries massively over-apply nitrogen today.

One way that governments can therefore reduce nitrogen pollution is to adjust the ratio of fertilizer prices to the return on agricultural products. They can adjust subsidies to make it costly for farmers to overuse fertilizers. Instead, they could re-allocate these financial resources towards practices that have positive environmental impacts.

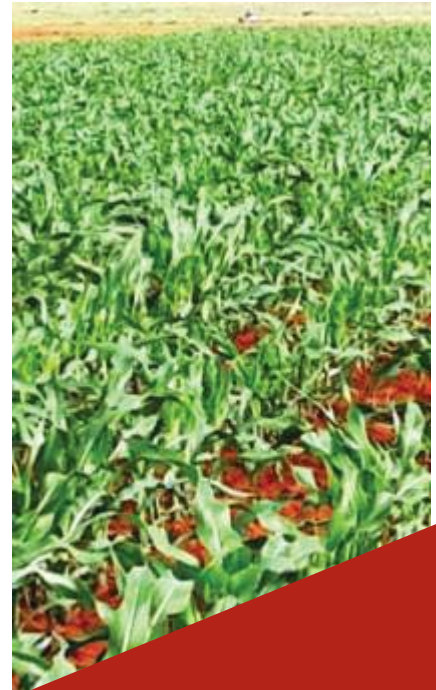
Another option is to invert the financial incentives: rather than subsidizing fertilizers, you could tax them.

We might want to make fertilizers more expensive for countries that overuse them. But we actually want to do the opposite for countries with large yield gaps. Many countries across Sub-Saharan Africa use barely any fertilizer at all. They achieve very poor

But with emerging technologies, we can do better. Thanks to information from drones or satellite imagery, we can implement 'precision farming', which allows us to see exactly where fertilizers are needed the most.

Plant breeding technologies could also offer new opportunities. We can try to improve how efficient we are at using nitrogen, but there's an opportunity to improve how efficiently plants use it too.

Let's not forget that one of the most promising solutions and one we often overlook is the simplest and oldest of all. Legumes (crops such as beans, peas and lentils) perform their own magic when it comes to nitrogen. They have the ability to capture nitrogen in the atmosphere and transform it into reactive nitrogen on their



“Fertilizers help us to achieve higher crop yields. This is an obvious net positive for humans: farmers can produce and earn more, and the world has more food. What's less obvious is that this has a large environmental benefit. Higher crop yields mean we need to use less land for farming. ”

yields as a result. Providing subsidies for fertilizers and other inputs would be of massive benefit.

One of the challenges of putting fertilizer on your crops is that it can be hard to know where it is needed. Some parts of your field might be lacking in nitrogen while others have more than enough. Often the easiest and quickest solution is to apply it everywhere, especially if fertilizers are heavily subsidized and cheap.

own. This is called 'biological fixation'. Unlike most other crops where we have to add additional nitrogen, they create it by themselves. Growing more legumes – either on their own, or alongside other crops – is one of the easiest ways that we can bring nitrogen into the soil.

Large policy changes and technological advancements are often needed to make a large difference, but we shouldn't underestimate the impact that education

can make.

Many view crop yields and environmental pollution as an unavoidable trade-off. It doesn't have to be. We can reduce pollution a lot without reducing crop yields. Less pollution, more food, higher farmer returns, and less farmland make this a problem with multiple wins if we can implement the right solutions.

Integrated Pest Management: Protect Yields Wisely

Pests are a major hazard that damage crops and turn farmers' efforts into a waste of time and resources. Thus, their control is a significant task that warrants serious treatment and timely response. Agriculture tackles the issue with integrated pest management.

What Is IPM: A Concise Abbreviation for A Comprehensive Approach

IPM stands for integrated pest management that combines several tools and methods. When it comes to integrated pest management definition, we can elaborate it as certain measures to eliminate, kill or prevent pest numbers on agricultural areas with minimum harm for nature, people, and protected plants.

The term 'pests' relates not only to animals or insects proper but weeds and diseases as well. Their damage has a dramatically strong impact on yields, and sometimes, seedlings were destroyed completely. Pests attack plants from everywhere: rodents and nematode spoil roots in the earth, snails, and larvae destroy leaves and berries coming from the ground, and birds eat up fruit and seeds attacking from the air. The list won't be complete without fungi, viruses, bacteria and other parasites, to mention a few.

The classification of pesticides features multiple groups of unwanted organisms that harm crops, with a certain pesticide type for each: herbicides, rodenticides, insecticides, animal repellents, avicides, nematicides, larvicides, bactericides, fungicides,

antimicrobial substances, etc.

Why Chemical Crop Protection Products Are Dangerous?

The key feature in the definition of pesticide is that it is a chemical remedy. The application of chemicals to kill pests is a common practice in many countries. However, there are several reasons why organic farming and sustainable agriculture principles recommend restraining from it:

1. Environmental pollution (soil, air, water)

Pesticides require time to split into less aggressive components, and some of them tend to accumulate. These chemicals

[To Page 20](#)



From Page 19

are washed with rains, transferred with underground waters, evaporate from the soil surface and come into the atmosphere when sprayed with manned and unmanned aerial vehicles.

2. Harm for humans – harmful chemical compounds induce health issues in people.

3. Danger for animals – pesticides kill non-target (beneficial or harmless) species that habituate in the fields or orchards.

4. Unintended effect on the end product – excessive usage burns leaves and roots, causes plant fading, and crops tend to store dangerous amounts of pesticides harmful for consumers.

5. Pest resistance – pests develop resistance when substances are applied continually. That requires greater dosage and new pesticide types. The scenario runs the worst when pests taste the poison and prefer it more than their usual source of nutrition, beyond all scientists' expectations.

Integrated Pest Management Methods

Harm from applying agricultural chemistry explains why it is the last step that agrarians take only when all the others are inefficient.

Biological control – implies a typical way of destroying pests as it happens in nature. Predators kill their prey that damages crops, for example, ladybugs reduce aphid numbers. This method also involves parasitoids, pathogens, and herbivores. It is implemented either by boosting the

predator population in their primary habitat or by importing beneficial species from other regions. Exploiting allelopathic and pest-killing properties are ultimately helpful in this respect, too.

- 'Foreign' predators may not cope with the task;
- Introduced animals become pests themselves with time if there are no natural enemies to control their population in the new environment;
- Reduction of certain species may give rise to secondary pest invasions.

A renowned example of a food chain error is the import of rabbits to Australia. With time, their population turned to be a real nuisance to farmers alongside indigenous kangaroos

or dingoes. The cane toad is another case illustrating biological control failure in this regard when it refused to hunt the target species and became a pest itself.

However, the history of agronomy witnesses efficient results as well. The number of wild rabbits was significantly decreased with myxomatosis virus born by mosquitoes, provided the areas were abundant in them. In the regions with a lack of mosquitoes, the idea was implemented with a flea-borne



virus.

Advanced integrated pest management employs innovative solutions. Thus, the Israeli company BioBee successfully eradicates Mediterranean fruit flies with sterile insect technology. It neutralizes males and releases them in nature. Their mating with wild fertile females results in no vibrant offspring. This solution is extremely helpful to orchard and vineyard owners in Israel.

Biopesticides are natural repellents containing plant extracts or oils. A classic remedy to tackle moths is the scent of lavender.

Physical/mechanical control involves:

- Tilling to destroy weeds or eggs/larvae;
- Covering/mulching to eliminate weed growth with the absence of sunlight;
- Physical removing/picking out;
- Steaming soils to kill pathogenic bacteria causing plant diseases;
- Constructing screens for birds and insects;
- Building fences around fields or putting traps as natural barriers for wild animals;
- Placing scarecrows in the fields.

Even though these solutions bring fruitful results at times, they are costly. In the case



Crop Monitoring Has A Plan For Efficient Pest Control

An integrated pest management plan includes several basic steps common in every situation:

1. Checking the area for pest presence and determining, which of the following is not a sign of possible pest infestation: species, numbers, infested terrains, volume of damage.
2. Identification of pest hazard warrants taking proper measures to eradicate dangerous pests, combining different methods and eliminating the chemical control consequences.
3. Result assessment allows making conclusions to understand either the treatment was efficient or not.
4. Prevention of infestation in the future will save costs and resources for treatment proper.

How does it work with Crop Monitoring?

1. The platform monitors your fields in real time with satellite imagery and provides vegetation index charts.
2. Altered vegetation indices signal a problem. In particular, when the NDVI index drops, there is a great probability that this is because of high pest numbers.
3. The system is able to set a scouting task to check the terrain more precisely and with a scout app confirm the issue. It immediately notifies you about the urge of pest management, enabling you to make a timely decision to treat the crops and save the yields.
4. Specification of infested areas and differentiated application of plant protection products minimize the damage for humans and nature as chemicals are used only when it is really necessary.

Thus, you are aware of the problem once it arises. An early assessment allows you to address it promptly and resolve it with maximum success.

of Australia, even the highest fence would not hamper kangaroos capable of jumping three meters high. So, they are not always useful as well.

Cultural control utilizes:

- Crop rotation when alternative crops are improper for pests damaging other groups of plants. For example, rodents threaten grain yields, birds and snails damage strawberries, potato beetles attack potatoes, tomatoes, and eggplants. If the habitat is not acceptable and there are no preferred nutrients, pests will leave for more lucrative places.
- Changes in irrigation: excessive water saturation provokes root diseases.
- Plant conservation/quarantine when a crop is isolated until it is mature enough to resist the pest threats.
- Chemical control implies the usage of pesticides when the above-mentioned methods can't efficiently combat the invasion or when their implementation is impossible due to certain circumstances. It is significant:
 - To minimize their harm for non-targeted organisms (humans, animals, and crops);
 - Ensure a durable effect without developing pests' resistance;
 - Treat only the problem areas, not the entire field.

Drought-tolerant maize project pioneers a winning strategy for a world facing climate change



As partners come together as One CGIAR to enact a bold climate-centered strategy, projects like CIMMYT and IITA's decades-long work on climate-smart maize can help show the way forward.

Since the 1980s, the International Maize and Wheat Improvement Center (CIMMYT) and the International Institute of Tropical Agriculture (IITA) have spearheaded the development and deployment of climate-smart maize in Africa.

This game-changing work has generated massive impacts for smallholder farmers, maize consumers, and seed markets in the region. It also offers a blueprint for CGIAR's new 2030 Research and Innovation Strategy, which proposes a systems transformation approach for food, land and water systems that puts climate change at the center of its mission.



Nancy Wawira stands among ripening maize cobs of high yielding, drought-tolerant maize varieties on a demonstration farm in Embu County, Kenya. Involving young people like Wawira helps to accelerate the adoption of improved stress-tolerant maize varieties.

for improved, climate-adaptive maize seed in sub-Saharan Africa, thus strengthening local commercial seed markets and helping drought-tolerant maize varieties reach an increasing share of climate-vulnerable farmers.

Today, approximately 8.6 million farmers have benefitted from CIMMYT- and IITA-derived climate-adaptive maize varieties in sub-Saharan Africa. Millions have risen above the poverty line.

In addition to drought-tolerance, CIMMYT- and IITA-derived climate-adaptive maize varieties have been developed to tolerate multiple climate-driven stresses and to provide improved nutritional outcomes through biofortification with essential nutrients such as provitamin A and zinc.

The task ahead

In his recently published book, *How to Avoid a Climate Catastrophe*, Bill Gates says “no other organization has done more than CGIAR to ensure that families especially the poorest have nutritious food to eat. And no other organization is in a

better position to create the innovations that will help poor farmers adapt to climate change in the years ahead.”

CGIAR’s new strategic orientation is an important step towards making good on that potential. CIMMYT and IITA’s longstanding work on climate-smart maize offers an important blueprint for the kinds of bold, comprehensive, and collaborative research for development initiatives such a strategy could empower.

Over the course of the 10-year run of the first iteration of this collaborative work on climate-adaptive maize, the Drought Tolerant Maize for Africa (DTMA) project, CIMMYT and IITA partnered with dozens of national, regional, and private sector partners throughout sub-Saharan Africa to release around 160 affordable maize varieties. CGIAR recognizes climate-smart maize as one of the standout 50 innovations to have emerged from the institution’s first half-century of work.

Game changer

Maize’s importance as a food crop in sub-Saharan Africa is hard to overstate. So are the climate change-driven challenges it faces.

It accounts for almost one third of the region’s caloric intake. It is grown on over 38 million hectares, primarily under rainfed conditions. Around 40% of this area faces occasional drought stress. Another 25% suffers frequent drought and crop losses reaching 50%.

Drought-tolerant maize stabilized production under drought-stress conditions. Recent studies show that farmers growing drought-tolerant maize varieties in dry years produced over a half ton more maize per hectare than those growing conventional varieties -enough maize to support a family of six for nine months.

Such drastic results fed increased demand

Make Agriculture Attractive by Making it Pay, Youths are Interested

By Mary Karigu

There has been a debate on the role of youth in agriculture and how to involve them in agriculture.

However, inadequate focus has been channeled towards why majority of the youths have not adopted agriculture despite them being unemployed. This article will critically assess the current situation of agriculture in Kenya, the reasons why there is low adoption of agriculture as an occupation and career by youths and strategies that can increase engagement of youth in agriculture.

Kenya has an exceptional youthful population. According to KNBS (2019), 35.7 out of 47.6 Million people comprising of 75% of the total population is comprised of people who are below 35 years of age. The census 2019 further reveals that 32.7 3 million people live in rural areas implying that Kenya have youthful rural population. With agriculture continuing to be the predominant source of employment and livelihood in Kenya by supporting approximately 80% of the population in the rural areas, the large youth population can be considered an important asset for agricultural development.

Agricultural Sector Development Strategy (2010-2020), agriculture sector is the backbone of the Kenyan economy contributing to approximately (24%) of annual GDP. In this regard, the sector has enormous potential in eradicating poverty, wealth, and employment creation.

However, today agriculture is predominantly controlled and undertaken by the older generation while young people continue to face unemployment challenges. Majority of Kenyan farmers are old with their age ranging between 50 – 60 years. This is a worrying situation considering that the population of Kenya continues to increase with current population standing at 47.6 Million its projected increase being approximately 66 million by 2030 and 97 Million by 2050. This calls for a revolution of the agricultural sector including an energetic and innovative agricultural workforce which the youth can provide to ensure food and nutritional security and support the economy.

According to the Kenya Agribusiness Youth Strategy, agriculture sector offers opportunities that can be tapped and explored to reverse the increasing youth unemployment trend. Thus, the youth are at the heart of transformation of the agricultural sector.

There are various factors that hinder effective engagement of youth in agriculture and adoption of agriculture as a livelihood strategy and a business. Some of these factors include perceived of high labour intensity particularly in production, poor attitude by youths, negative perception towards agriculture (associated with

According to the



low incomes and as a job for the old, uneducated population), inadequate skills and knowledge in agribusiness and unsupported land tenure systems.

Key issues in the sector and strategies of increasing youth engagement in agriculture

Strategy i: Promote the higher value chain stages other than production.

Kenyan agriculture continues to be more focused on production level while there is an opportunity to create value at the upper stages of the value chain including processing/ value addition and marketing. While production and productivity are

around agribusiness. This would address the perception that agriculture is labour intensive and 'dirty' due to its focus on production.

Strategy ii: Implement strategies, legislation and policies that promote youth engagement in agriculture

The barriers for youth to engage in agriculture as a livelihood strategy can be addressed through implementation of some of the agricultural policies in the sector including Kenya Agribusiness Youth Strategy and the Agricultural Sector Transformation and Growth Strategy (ASTGS). There is also need to review

other interesting enterprises that do not require large pieces of land to undertake.

Strategy iii: Develop agricultural skills that match industry requirements

Low perception by the youths in agriculture in the past have resulted to few youths taking an agricultural career path while the education system has also not been keen in providing needed by the industry actors; there has been an issue of skill mismatch with industry requirements.

There is need to build talents and skills across agriculture with a special target on youths. This could be achieved through collective approaches between the industrial actors and education institutions. Industry actors should engage universities, colleges, ATVET institutions and their students to collaboratively address key challenges facing each actor. This can be achieved through implementation of youth/students mentorship and internship programmes in their early careers to engage with experts in the agricultural fields of interest and linking them with institutions working in their area to develop skills and address specific industry challenges.

Strategy iv: Adopt an inclusive, collaborative approach

Transformation impact in the sector requires a coordinated and collaborative approach and private sector investment to re brand agriculture (e.g. by incorporating technology to make it less manual and laborious) and promotion of agricultural innovations to attract youth. All the relevant stakeholders and actors including government, private sector actors, investors and youths/their organizations need to work together as one in addressing challenges that affect the youth.

Mary Karigu (Manager, Gender and Youth)



important aspects of the value chain approach, there lies numerous unexploited opportunities in the other value chain segments (such as transport and value addition) that are attractive to the youth.

There is need for private sector actors, development partners and government to commercialize agriculture by supporting youths to invest in the higher agricultural value chain stages which offer them interesting opportunities

our land policies to ensure they are youth friendly. This is because, land tenure issues continue to be a major barrier that hinder youths in engaging in agriculture due to ownership and management problems. This coupled with inadequate access to agricultural inputs, credit and extension services are major factors that disenfranchise youths from engaging in agriculture. Land issues also be addressed by supporting youths in innovations such as hydroponics, vertical bag agriculture among

Galana/Kulalu Ready for Large-Scale Commercial Production

Water and Irrigation Cabinet Secretary Sicily Kariuki has said the government has started the process of commercializing the 10,000-acre model farm at the Galana/Kulalu Food Security Project in Kilifi and Tana River Counties.



Sicily Kariuki, CS Water & Irrigation

Ms Kariuki said her Ministry and that of the National Treasury were in the process of identifying a local or international private sector actor to carry on with the work once the National Irrigation Authority (NIA) finalizes the setting up of basic irrigation infrastructure on the model farm.

The CS said that her ministry, through the NIA, was in the final stages of the setting up of the basic irrigation infrastructure on the remaining 4,900 acres of the model farm before the project is left in the hands of the private sector.

“The process is being managed by the National Treasury right now. Already investor briefings have been done. The project is packaged and is already out in the market under the National Treasury, which is the lead agency in all Public Private Partnership (PPP) programmes,” CS Kariuki said.

Ms Kariuki, who conducted an inspection tour of the project situated in Kilifi and Tana River Counties, said phase two of the project was at 72 per cent completion and that it was expected to be ready for commercialization by January 2022. “The government has decided that, given the efficiencies

of the private sector in terms of agricultural production, once we have finalised investing in the basic irrigation infrastructure, the 10,000-acre model farm is going to be competitively commercialised,” she told journalists after the tour.

The Water Cabinet Secretary, who was accompanied by NIA Chief Executive Gitonga Mugami among other senior officials, said that the bids for the commercialisation of the farm would be floated at international level to allow the best actor to carry on with the work with a view to enabling the project to produce optimally in line with government objectives.

“The current process of commercialization of the Galana/Kulalu model farm is one that has been opened up internationally. That means the best bid that we get in terms of the terms that the

[To Page 28](#)



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From Page 26



National Treasury has set out is the one that is going to come in and continue from where we stop,” she said.

Galana/Kulalu Food Security Project started seven years ago with the intention of opening up the more than 1.2 million acres of land belonging to the Agricultural Development Corporation and put it under irrigation.

The government then decided to commence the project by way of a 10,000-acre pilot farm, 5,100 acres of which have already been covered in the last three years and have started production of various crops, chief among them maize.

National Irrigation Authority is currently putting basic irrigation infrastructure on the remaining 4,900 acres, which, according to Ms Kariuki, is at 72 per cent level of completion and will be ready in the next

three months.

The Cabinet Secretary noted that the Galana/Kulalu Food Security Project was one of the government’s initiatives aimed at increasing land under irrigation from the about 540,000 acres in the country to more than 1 million acres as envisaged under the Vision 2030 economic blue print.

“This is part of the government’s vision of putting more land under irrigation. Our target currently is to grow from the 540,000 acres under irrigation and move this towards the target of one million acres under irrigation as envisaged with Vision 2030,” she said.

She said her ministry was at the tail end of finalizing and disseminating guidelines for farmer-led irrigation programmes at the micro level with a view to giving an enabling environment for more acres of land to be

put under irrigation.

“We are working with the World Bank; we have already finalised the draft guidelines for this and we will be moving to dissemination and the same is going to inform policy as we move forward,” she said.

The Cabinet Secretary faulted some senior political bigwigs in the country for alleging that the government had abandoned the Big Four Agenda, saying on the contrary, the government was busy working towards the realisation of all agenda items of Food Security, Affordable Housing, Universal Health Care and Manufacturing.

She said, for example, that her ministry has 650 projects between water, sanitation and irrigation across the country to enable food security as one of the major items of the Big Four Agenda.

Buying into New Seed



A mock shop helps researchers understand how Kenyan farmers choose maize seed when their preferred varieties are out of stock.

Mary Nzau enters a mock agrodealer shop set up on a field on the outskirts of Tala town in Machakos County, Kenya. On display are nine 2kg bags of hybrid maize seed. She picks one. By the look of it, her mind is made up. After a quick scan of the shelf, she has in her hand the variety that she has been purchasing for years.

Regina Mbaika Mutua is less lucky. The variety she always buys is not on display in the mock shop. As part of the experiment, the research team has removed from the shelf the variety she indicated she usually buys. The team's goal is to observe what factors influence her seed purchase decision in the absence of the variety she was expecting to purchase.

"Although I did not find the variety I was looking for, I picked an alternative as I have seen it perform well on a neighbouring farm," Mutua says, adding that she will plant it this season alongside recycled (farm-saved) seed on her one-acre farm.

Michael Mutua passes up the popular variety he has been planting for the previous two years. He picks one that has been advertised extensively. "I have heard about it severally on radio. I would like to experiment with this new seed and see how it performs on my farm. Should I like the results, I will give it a chance in ensuing seasons," he says.

The big adoption conundrum

The goal of the out-of-stock study is to improve an understanding of how farmers make their maize seed choices, says Pieter

“

It is better to have a diversity of product profiles as different market niches are captured within a particular agroecological zones. This is such that farmers may not just benefit from the minimum traits like drought tolerance, but also more specific traits they are looking

for”

[To Page 30](#)

From Page 29

Rutsaert, Markets and Value Chain Specialist at the International Maize and Wheat Improvement Center (CIMMYT).

“We do this by inviting farmers to a mock agrodealer store that we set up in their villages and give them a small budget to purchase a bag of seed. However, not all farmers walk into the same store: some will find their preferred variety, others won't. Some will have access to additional trait information or see some varieties with price promotions while others don't.”

Rutsaert acknowledges that breeding programs and their partner seed companies have done a great job at giving farmers access



to maize hybrids with priority traits such as drought tolerance and high yield. CIMMYT then works closely with local seed companies to get varieties into the hands of farmers. “We want to extend that support by providing insights to companies and public breeding programs on how to get new varieties more quickly into the hands of farmers,” he says.

The hybrid maize seed sector in Kenya is highly competitive. Amid intensifying competition, new varieties face a daunting task breaking into the market, independent of their quality. While farmers now have more options to pick from, a major challenge has been how to get them to adopt new varieties.

“Moving farmers from something they know to something they don't is not easy. They tend to stick with what they know and have been growing for years,” Rutsaert says.

Pauline Muindi, gender research associate with CIMMYT, acted as the stand-in clerk at the mock store. She noticed that farmers tend to spend very little time in the shop when their preferred variety is available. However, this all changes in the out-of-stock situation, pushing farmers to step out of their comfort zone and explore new options.

The first step to overcoming this challenge is to entice maize farmers to try a new seed variety, even just once, Rutsaert observes. If it is a good variety, farmers will see that and then the market will work in its favour: farmers will come back to that variety in subsequent years and tell others about it.

“This information is generally already available on seed packets, but we live in a world of information overload. Promoting certain attributes through in-store signage is an approach that is widely used to help consumers make more healthier food choices. Doing the same for new seed varieties makes a lot of sense.”

“The good news is that many of the varieties we are currently seeing on the market have performed well — that's why they're popular. But there are newer varieties that are even better, especially in terms of attributes like drought tolerance. We would like to understand how farmers can be convinced to try out these newer varieties. Is it about the need for more awareness on varietal traits? Can we use price promotions? Or are there other factors?” he says.

Does seed price matter?

“With today's climate uncertainty, it is better to stick to a variety that is adapted to such climate rather than banking on a variety one is oblivious of. The risk is not worth it,” Nzau says. She adds that she would rather buy a higher-priced seed packet she knows and trusts than a lower-priced one that she has not used in the past. Radio promotions of new or other varieties have limited sway over her decision to make the switch.

Faith Voni, another farmer, agrees. “It is better to purchase a higher-priced variety whose quality I can vouch for than risk purchasing a lower-priced one that I know little about. I do not wish to take such a risk.” Voni says she would also be more inclined to experiment with another variety that she had seen perform well on a neighbour's farm.

Michael Mutua holds a different view. “If there is an option of an equally good but new variety

To Page 32



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From Page 30



that is lower-priced than the variety I prefer, my wallet decides,” he says.

Vivian Hoffmann, an economist at the International Food Policy Research Institute (IFPRI) and collaborator on the study, says price can be key for convincing consumers to try a new product. “Our previous research on maize flour choice found that a provisional 10 percent discount boosted sales tremendously,” Hoffmann says. “Of course, that only gets your foot in the door; after that, a new variety will need to win farmers over based on its merits.”

Hoffmann is interested in the extent to which drawing farmers’ attention to key varietal attributes influences their seed choice. “This information is generally already available on seed packets, but we live in a world of information overload. Promoting certain attributes through in-store signage is an approach that is widely used to help consumers make more healthier food choices. Doing the same for new seed varieties makes a lot of sense.”

The value of drought tolerance

Situated on Kenya’s eastern region, Machakos is characterized by persistent water stress. Climate change induced erratic rainfall has pushed traits that can tolerate the unfavourable weather conditions in the favourite’s corner. While other traits such as high yield and disease resistance are equally

important, the seed, when planted, must first withstand the effects of droughts or water stress in some seasons and germinate. This is the most crucial step in the long journey to either a decent, bare minimum or no yield.



A lot of farmers still plant recycled seed alongside hybrid varieties. But these are no match to water stress conditions, which decimate fields planted with farmer-saved seed.

“If a variety is not climate resilient, I will likely not harvest anything at all,” says Nzau. She has planted a drought-tolerant variety for ten years now. Prior to that, she had planted about three other varieties as well as recycled seed. “The only advantage with recycled seed is that given the right amount of rainfall, they mature

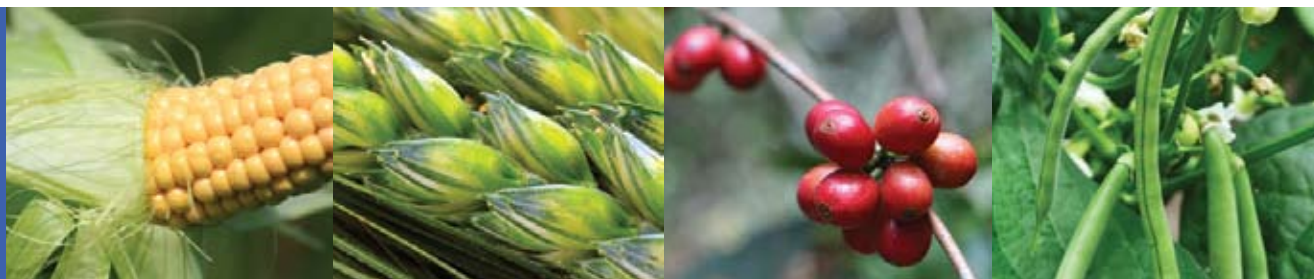
fast — typically within two months. This provides my family with an opportunity to eat boiled or roast maize,” she notes.

However, varieties need to do more than just survive harsh weather conditions. Breeders face a daunting task of incorporating as many traits as possible to cater to the overarching and the specific interests of multiple farmers. As Murenga Mwimali, a maize breeder at the Kenya Agricultural and Livestock Research Organization (KALRO) and collaborator in this research says, innovations in breeding technologies are making breeding more efficient.

“It is better to have a diversity of product profiles as different market niches are captured within a particular agroecological zones. This is such that farmers may not just benefit from the minimum traits like drought tolerance, but also more specific traits they are looking for,”

Mwimali says.

Smallholder farmers continue to play a central role in the seed development process. Capturing what happens at the point of purchase, for instance, at the agrodealer, and understanding how they purchase seed offers valuable insights on the traits that are deemed essential in the breeding process. This work contributes to CIMMYT’s focus on fast-tracking varietal turnover by turning the levers towards a demand-driven seed system.



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Dr. Tilahun Amede is the Head of Resilience, climate and soil fertility at Alliance for a Green Revolution in Africa. He speaks on how to address the problem of soil salinisation and why it has become rampant in Kenya and many other countries across Africa.

Why soil salinisation is a common problem



Dr. Tilahun Amede

What is soil salinisation and what causes it?

Salination is a form of degradation due to excessive accumulation of water –soluble salts, which either exist naturally in the soil or because of poor agriculture practices. In coastal areas, ocean overflow and associated swamps, are a common cause of salinisation. This drives up the soil pH above the 5.5 to 7.5 optimum range; which hampers its ability to grow food crops. Soil salinisation is a major challenge and a threat to food production globally, particularly in arid and semi-arid regions.

Salinisation is mainly caused by drought conditions or poor irrigation practices. In dry areas, heat causes water to evaporate, leading to concentration of salt around the surface. Irrigation using ground water that is saline, on the other hand, leads to



accumulation of salt in the soil surface over time. With effect of climate change, drought is more prevalent, intense and frequent, thus necessitating irrigation and hence the risk of salinisation.

How does a farmer know their soils are saline or not?

It is difficult to physically see soil is saline except in acute cases where white crusts occur on the surface. Crops growing in salinated soil could wilt or get stunted even under good soil water regimes. Farmers need to get their soils routinely tested to ascertain the pH and correct it before it gets out of hand. Unfortunately, once soils are saline, there is no quick fix. It can be mitigated, for instance, by growing legumes, which fix nitrogen for consecutive years and release ions into the soil, reducing pH. Conservation agriculture methods such as crop rotation, use of organic fertilizer and good irrigation practices are important in preventing salinisation.

What are the disadvantages of having saline soils?

Saline soils reduce the ability for crops to take up water and limit the availability of micro-nutrients that are important for crops to grow, leading to decreased productivity. They also concentrate toxic ions that are harmful to plants and other beneficial micro-organism. The soils may also remain crusted with salt and difficult to plough. In general, salinity affects the



of increasing salinity in the region is high with the rising threat of climate change.

With most soils in Africa becoming saline, what is the continent's future when it comes to food production?

We need to adopt sustainable farming to maintain healthy ecosystems and ensure that salinisation does not occur. This includes improved management of irrigation schemes, increased use of organic fertilisers, diversifying our production towards less sensitive crops like sorghum, millet and barley. Irrigation needs to strike a balance in as far as water management is concerned; using not more than is required. Crop rotation ensures that there are different crops with different nutrient needs, thus boosting soil health.

We can only end hunger and poverty in Africa through resilient food systems, which start with healthy soils. Africans population

overall profitability of farms.

There has been a long-held belief that increased (mis) use of inorganic fertilisers have contributed to saline soils, is that a fact or myth?

While inorganic fertilizer is not the major source of salinity, excessive use of certain fertilisers, such as potassium chloride or ammonium sulphate has been found to cause salinisation. Several other factors have been linked to salinisation including increased frequency and intensity of drought, poor irrigation practices, population pressures leading to destruction of wetlands and other ecosystem for farming.

Soils in Africa have been described as mostly saline. Is that the case?

Globally, the Food and Agriculture Organisation estimates that there are more than 833 million hectares of saline soils, with salinisation taking up to 1.5 million



hectares of farmland from production every year. In Africa, about 30 percent of the soils are considered to be saline. This is a huge threat to food production for a continent that is struggling to feed itself. The Great Rift Valley, which includes Kenya, have soils of volcanic origin, but also are located in arid and semi-arid areas where precipitation is insufficient to drain the soluble salts contained in the soil profile. Hence, the risk

set to double by 2050, all of us need to minimize the damage to human health, and the environment.

Conservation agriculture needs to be promoted, as appropriated including agricultural practices that improve and strengthen soil structure, increase water retention, and reduce production cost while improving crop yields.

National Irrigation Authority reclaims 5,400 acres of rice farms



Government also rehabilitated the dykes.

In Summary

- The entire area was flooded last year as a result of the rising water levels in Lake Victoria.
- However, through the government's intervention, the authority invested in drainage and pumping water out of the scheme where rice is grown.

The National Irrigation Authority has reclaimed 2,200ha (5,436 acres) of rice farms in West Kano irrigation scheme in Kisumu county that was submerged, crippling production.

The entire area was flooded last year as a result of the rising water levels in Lake Victoria.

However, through the government's intervention, the authority invested in drainage and pumping water out of the scheme where rice is grown.

According to the NIA Nyanza region coordinator Joel Tanui , the government also rehabilitated the dykes and farmers have gone back to full production in the area.

Speaking to reporters at Ahero irrigation scheme, Tanui said the government target to increase the acreage under rice production to 30,000ha in two years' time.

"The potential of irrigation, particularly in Kano plains is still very huge and untapped," he said, adding that Nyanza region has the highest potential in terms of irrigation in the country.

"In another two years, we have a target to bring on board another 30,000ha under irrigation in Kisumu County, " he said.

He said this will depend on the completion of the multibillion Koru- Soin dam which will provide water to the area for irrigation.

Rice Husks

Tanui said the area was blessed with rich agricultural soils, abundant water and human resource capacity.

"The government is investing in human capital and infrastructure support in the region so that it can realize its full potential in regards to irrigation, "he said.

The regional coordinator said NIA was currently scouting for new irrigation areas towards its mission to expand production.

"Over 500,000 ha of land should be under irrigation in Kenya by 2030 so that we are able to feed the entire nation, "he said.

He noted that the government's aggressive campaigns targeting



expansion of land under irrigation in Nyanza region is already bearing fruit.

In Kisumu County alone, through the National Irrigation Authority programme, 13,000 acres of land has been put under irrigation.

From this portion of land, the county now produces 30,000 metric tons of rice every season, and earning Sh2 billion.

He said the expansion program in Nyanza has benefited 10,000 rice farmers.

“Irrigation programs initiated in the area has also created job opportunities. In the 13,000 ha, in Kisumu alone, we have created over 50,000 jobs directly to farmers and youths,” he said.

He said that NIA has been able to double production of rice per acre piece of land in the area.

He said farmers used to get 20 bags of rice per acre but now the production has gone up to between 40-50 bags per acre.

“This is because we provide farmers with fertilizer, certified seeds and they have also embraced mechanized farming which was lacking and led to post harvest losses,” he said.

However, rice farmers are still facing marketing challenges.

Last year, President Uhuru Kenyatta directed Kenya National Trading Company (KNTC) to buy rice from local farmers to supply to government Institutions across the country.

This was to address the challenges farmers were facing in the hands of brokers and middlemen.

However, rice farmers from Kisumu County had a challenge with the supply to KNTC because of quality parameters set for them. KNTC, according to Tanui, wrote to farmers raising concerns over quality of rice supplied.

He said the local farmers were used to selling their rice raw to those buying from

market will be solved,” he said.

The farmers are also grappling with the birds menace.

According to the authority, rice farmers in Kano plains lose up to 15 percent of the produce to birds.

The coordinator said farmers lose Sh 200 million per season to birds’ invasion. He said the authority was in talks with the ministry of agriculture and the county government of Kisumu to see how best the issue can be addressed.

He said two approaches were being explored, one of which include controlling the birds breeding sites chemically to reduce the population.

“We are also testing mechanical birds scaring method. A study is underway on the mechanical method. Two university students are working on the initiative,” he said.

The authority is also in discussion with the county government of Kisumu to put up a major rice Mill in the county.

Western Kenya rice mill that is the only available rice Mill in the area doesn’t have the capacity to mill the crop given the expanding production.

The private mill was established in 1992. Tanui appealed to private investors to take advantage of the existing business opportunities to invest in big rice mills.

“The government has heavily invested on infrastructure development in rice production. Under public private partnerships, the investors should now grab the existing opportunity to establish big rice mills here,” he said.



their farms.

On Tuesday, he appealed to the company to partner with NIA to train farmers on the milling parameters.

“The farmers are willing to sell to government Institutions. KNTC was offering good prices and payment was prompt. If we address this, the issue of

The Gender Quest: Empower women in Agriculture, Eradicate



The word gender describes a social construct that ascribes roles, rules (norms), responsibilities, opportunities, power, behaviour and what the society considers appropriate for men and women. Though fluid and context-specific, the construction of gender underlines the reason for the persistence of gender inequality experienced differently by men and women. Gender construction is as old as the human race, and so is gender inequality. We are all influenced by gender.

Gender norms seem to influence what is appropriate to do in our society. As a result of gender, girls and women often have lower social status, less access to resources that should naturally be given without applying the gender spectrum. These issues are at the core of the contemporary gender system, which systematically empowers one against the other, consequently producing a bidirectional relationship between gender inequality and development outcomes.

While more women farmers in Africa continue to engage in farming, look for and adopt high yielding nutritious and climate-resilient crop varieties, they face an array of constraints making full involvement in and contribution to agriculture difficult. One of such is the lack or poor involvement of women farmers in technology development and transfer processes.

The glaring inequality between men and women farmers in the African agricultural sector is alarming evidence that calls for fair, inclusive and sustainable development. Gender productivity gaps vary across and even within countries, but recent studies suggest that gender gaps are in the range of 10% to 30%. Women have far less access than men to input,

Gender issues in agriculture including access to and control over resources continues to be the underlining factor widening the gap in production

financial services, land ownership, training and other means of increasing agricultural production and improving family income, nutrition and health.

Gender gap in agricultural productivity means that crop production is lower than its potential. Closing the gender gap in access to production capitals alone has been estimated to have the potential of lifting 100–150 million people out of hunger, thus resulting in benefits that spread far beyond female farmers.

Gender issues in agriculture including access to and control over resources continues to be the underlining factor widening the gap in production between male and female farmers in Africa. Much of the work women do as household providers and agricultural producers is unpaid, making their contribution essentially invisible. Women and female-headed households are disproportionately affected by economic recession and higher food prices and trade policies.

The crucial question becomes, how do women farmers involve in, equitably benefit from and contribute to agriculture development? We cannot overcome these challenges while age-old, ingrained ideas of gender roles deny women's full participation in decision-making and social and economic development. The stage of intentions, promises and pious hopes should be over; we must now not only act but must all act targeted to challenge and combat gender inequality. Investing in women farmers significantly increases productivity, reduces hunger and nutrition, and improves rural livelihoods for both women and men, and the next generation, partly because women spend their money and their produce differently and save their

income by investing in areas such as health, education, social assistance, and child nutrition.

Approaches and actions to reduce gender inequality

- a) Targeting to ensure that nobody is left behind and no need is forgotten or neglected
- b) Reaching the areas of interest and impactful
- c) Customize interventions that equally benefit women actors of the agricultural value chain
- d) These actions require urgent interventions to act now by investing more resources and energy in the empowerment of women farmers to facilitate their access to productive resources and their capacity in agricultural innovations for a fairer, more equitable and more balanced world.

e) Go beyond the production stage to support women in each key segment of the agricultural value chain.

f) Identify entrepreneurial and paid off-farm options for women in each key node of the agricultural value chain.

g) Provide a 'package' of support services such as credit, business development training, and transportation services for women farmers.

h) Facilitate reducing women's drudgery and access to inputs, equipment and skills to help them take advantage of innovations, market, and development outcomes.

Authors: Jummai O. Yila, Scientist – Gender Research

Almamy Sylla, Scientific Officer, ICRISAT, WCA Bamako



Digitization equipment set to accelerate Kenya's breeding programs

New equipment will speed up and enhance the accuracy of national breeding processes including seed preparation, data collection and inventory management.



Last month, the CGIAR Excellence in Breeding (EiB) platform handed over digitization equipment to the Kenya Agricultural and Livestock Research Organization (KALRO) as part of ongoing efforts to modernize the public agency's crop breeding programs. The handover of the equipment, valued at roughly \$85,000, took place at KALRO headquarters in Nairobi, with representatives from the International Maize and Wheat

Improvement Center (CIMMYT), EiB and KALRO in attendance.

KALRO received 23 units of equipment including seed counters, label printers, handheld data collectors, tablets and package printers. These will help the organization speed up and enhance the accuracy of various breeding processes, including seed preparation, data collection and data analysis. They will also support inventory management within KALRO's maize, wheat, rice, sorghum, bean, soybean and potato breeding programs at six of its research centres in Kenya.

Dispensing with laborious systems

A lack of digitization equipment hampers the research efforts of many national agricultural research systems (NARS) across Africa. This adverse situation is compounded by unreliable institutional memory, which constrains NARS efforts to breed an assortment of crop varieties efficiently.

"Currently, KALRO uses very laborious systems including manual layouts and collection, followed by manual data entry into computers. This old age process is prone to data entry errors and delays in analysis, publication and reporting," says KALRO Director General Eliud Kireger.

"With the equipment we are receiving, information and data can be recalled by a click of a button. The equipment will also significantly reduce research costs related to labour, thus freeing our scientists

to focus on core research activities.”

The equipment will also support KALRO's ongoing efforts to digitize its historical data, especially for the maize and wheat programs using the Breeding Management System (BMS). So far, 20 years of maize historical data has been uploaded onto the BMS platform for ease of access.

Prepped for emerging challenges

The CGIAR EiB platform was established in 2017 to help modernize public breeding programs in the CGIAR and NARS to increase their rates of genetic gain. In recent years, there has been an upsurge in challenges including climate change, population growth, rapid urbanization, changing dietary inclinations, transboundary movement of pests and diseases. These have exerted an enormous strain on food production systems and elicited the urgency to prioritize the adoption of new plant breeding techniques and technologies to address current and emerging threats. This calls for a holistic approach to tackle the issues including better agronomy and policy, according to EiB NARS Coordinator Biswanath Das.

“Modernizing our plant breeding programs to develop new, climate smart, market driven varieties will be at the heart of the solution,” says Das. “We must ensure that public plant breeding programs are not left behind because for many crops in Africa, there is limited private sector interest. Public breeding programs must shoulder the responsibility for ensuring the development and adoption of the next



generation of crop varieties.”

Already, KALRO breeding programs, in collaboration with international CGIAR centres, have played a leading role in supporting farmers in sub-Saharan Africa to address many emerging plant threats such as wheat rust (UG99), maize lethal necrosis (MLN) and fall armyworm.

As part of its commitment to supporting NARS partners, EiB provided over 10 million Kenyan shillings (\$92,000) worth of material and in-kind support to various KALRO breeding operations in 2020. This included genotyping support for maize and wheat, support to adopt the BMS digital data management system, technical support and training of KALRO breeders. Much of the digitization work is driven by EiB's Operations and Phenotyping module, led by Gustavo Teixeira. “We'll continue to consider a whole range of devices and solutions,” says Teixeira. “It's a part of our culture of continuous improvement, so breeding programs can focus on what really adds value to their clients.”

EiB will continue to support NARS across Africa and beyond to digitize their operations, and is working with partners to secure more equipment, training and resources. With this digitization project, EiB has targeted 24 breeding programs in 14 African countries. These include programs run by AfricaRice, CIMMYT, the International Institute of Tropical Agriculture (IITA) and the International Rice Research Institute (IRRI).

“We want to do more to support centers to improve their operations so they can achieve the most effective and cost efficient phenotypic processes — agronomic practices, seed processing and other areas,” explains Teixeira. “We aim to expand to more programs and partners.” EiB and partners are supported by CGIAR Trust Fund Contributors and the Crops to End Hunger initiative, via the Bill and Melinda Gates Foundation, GIZ, BMZ, USAID, UK Aid, ACIAR and other partners.



Examining the Farming Crisis in Kenya

Being an agricultural country from the beginning, Kenya ranks among the top countries in farming outputs. With agriculture employing more than 70% of Kenya’s workforce, it’s also the largest source of livelihood in Kenya with more than 90% of its rural households depending primarily on farming. Despite the incredible importance of farmers to the Kenyan economy and way of life, farmers in Kenya have a history of debts, extreme poverty and low quality of life. In addition to these existing problems, the global pandemic has greatly intensified the pressure on farmers and has made it considerably more difficult for many to sustain themselves, resulting in a farming crisis in Kenya. According to our source, most people in the farming sector in Kenya are loosing hope.

Farmer Debts and Loans

According to our investigations, the average Kenyan farmer earns about Kshs. 100,000 annually. As reported earlier, only about 50% or less of the household income of a farming family comes from farming, while the rest comes from other sources. To supplement for low income, many farmers take up more than one job, sometimes working as a bus driver or security guard for example. With the pandemic and nationwide lockdown, many farmers lost their second source of income, further aggravating their already strained financial situation.

The rising costs of farming and the low pay for farm produce have pushed many farmers into a cycle of vicious debts. We interviewed Mr. Kioko Mutua from Makueni County. Mr. Kioko attempted to secure a loan of a few thousandshillings, due to fears that his farm would be seized.

Unable to sustain himself and his attempt to secure a loan failing, he ran from the village in June 2020. Anthony Kioko, his 24-year-old son, had to stop his schooling in order to save money on tuition fees so that he could help his family. Gerald Musyoka described the pandemic and the enormous stress that his family must endure when he said: “We are now having to beg for money from someone or the other.”

The Reason Farmers are in Debt

According to an earlier publication, 85% of Kenya’s farmers operate on less than five acres of land. With 82% of farmers being small and marginal and contributing 51% of agricultural input, small farmers are the backbone of the agricultural industry. Despite this, farming remains an unstable and difficult profession. In order for many small farmers to escape the clutches of poverty, they must find additional sources of income.

Risks in production further aggravate the low quality of life for small farmers. The increased cost of cultivation, inadequate irrigation, drought, flood and crop failure all contribute to the lack of viability in the farming profession and debt of farmers. Additionally, difficulty in selling within the market can make or break the income of a farmer. Agricultural costs and unstable incomes have caused many farmers to take on even more debt. Furthermore, money-lending due to necessity and often the inability to pay back loans, have pushed farmers further into poverty and debt. The nationwide lockdown only exacerbated these existing problems, which resulted in difficulty in taking produce to the markets and selling it.

Solutions to the Farming Crisis in Kenya

Despite the potential for productivity in the agricultural sector, low productivity in agriculture contributes to the difficulty and poverty among farmers in Kenya. Unutilized scientific knowledge and the mechanization of small farms are major solutions to the issue of low productivity. According to the World Bank, a key solution for increasing agricultural productivity and

improving the incomes of farmers is the adoption of innovative technologies and practices by farmers. These actions will facilitate farmers in improving their yields, managing inputs more efficiently, having a better quality of products, adapting to climate issues and conserving resources.

The Open Knowledge Repository states that efforts to improve agricultural productivity include the gradual reforms in the agricultural sector that have spurred innovation and changes in the food sector due to private investment. These efforts have been successful and continue to succeed in light of the ongoing policy and investment imperatives. Due to these efforts, agricultural growth has improved in recent years, but with a long-term rate of 3% improvement, agricultural improvement has been meagre in comparison to its potential.

Organizations that are making a Difference

International lending institutions offer major support to the agriculture and rural development of Kenya. Focusing on agriculture, resources, irrigation and rural livelihood development, their programs in Kenya have committed billions in net commitments. This money is going towards new technology, innovation systems, farmer livelihood support and poverty reduction efforts.

Many NGOs have emerged in recent years in order to improve the livelihood of farmers and to make farming a viable profession. Some organizations work on projects that target water harvesting and management, crop optimizations, afforestation and the conservation of resources. Additionally, they focus on improving child education, promoting women's empowerment, reducing illiteracy, responding to a lack of health care and assisting farmers struggling with extreme poverty. They provide farmers with



seeds samplings, pesticides and other supplies in order to alleviate the financial strain of farmers and ensure that they are able to support their families. They have constructed water harvesting structures, built trenches around hills to treat non-arable areas and improved and diversified agriculture in order to create additional employment in the farm sectors. To support those in poverty, it has aided in the formation and strengthening of village water supply and sanitation.

The farming crisis in Kenya has resulted in challenges for many families in the country. However, the efforts of such organizations should reduce some of the challenges farmers in Kenya are facing.



My Day with the Village Supreme Court

Early Saturday, PMQ 700 AM was ready to snake through the deep forest. “This death trap will boil before doing 100kms, why can’t you call for a cab? Why are you so mean? You have been given the last chance to appear in the commission of inquiry, yet you are risking. You are even taking mileage to launch for a claim. God forbid, you gave me a sting for a husband?”, Eve’s descendant complained. I did not answer any of the questions for I knew every answer will lead to another question.

Thank God PMQ was on a rhino charge mood, he roared like a four by four by far. In no time, it had hit 100kms per hour. Eve’s descendant sat quietly looking at the dailies which she had bought to keep her busy in case we stalled. In less than 2 hours we had done 180Kms with only five to go. Suddenly PMQ started coughing, then croaked, jerked and suddenly stalled. “I knew it, I knew it”, Eve’s descendant laughed. “The problem with you is you cannot listen”, she complained as she stood a Kimbo by the road side.

Some passersby helped me push it to the edge of the road. “*Mzee tupange*”, their spokesman said. “Yes”, a colleague added, “*Hii Kazi tumefanya si bure, harakisha tunachelewa na case*”. I gave them a two hundred shillings note and they left. I had two important phone calls to make, so I reached for my phone. I was shocked to find my sophisticated gadget had no network. Two old passersby asked what had happened and I explained to them. “Let me help you my son, this phones you keep on pushing up using a finger do not work well in the village. The network around is only fo *Mulika Mwizi*, so use my phone”, said one of them.

I called Simba my mechanic. The man who calls himself engineer though he never progressed to the classes whose pupils carry packed lunch. He laughed and started issuing instructions, “open the bonnet, Pull the pipe that comes from the fuel tank to the carburettor, sip a mouthful of petrol then vomit it on top of the air cleaner. It will go direct to the carburettor, the car must start”. The first sip went direct into my stomach with some little coming out through my nostrils. This gave me a black out for some few minutes. The

second worked and the car started. Simba requested for his consultation fee.

All this time, the two men were conversing in low tones a few metres from the car and the village pastor was praying in a language I did not understand hitting the car with the bible. He then smeared some liquid on the boot and the bonnet, took a broom and swept in front of the car. He then instructed me not to reverse but engage a forward gear. “*Mimi nimekwambia siku nyingi, panda mbegu na hizi shida zitaisha, sasa panda, kisha ununue hii mafuta niliyopaka gari na hiki kifagio kwa shillingi mia mbili*” he added. After paying, he left and the two elders called me for what they termed “men talk”. “Our son”, the elderly of the two started. “Next time never use this road, your enemies had sent the village witch doctor, he picked some soil from the road last night. Immediately your car stepped on the spot, it stalled. This was to make sure you will not get to the Supreme Court in time. In addition when you get there, do not sit on the chair they will show you, request for another”. As usual, they requested for some airtime and consultation fee which I paid. I joined Eve’s descendant in the car and Slowly we snaked into the village square where the hearings were to be heard in public.

On arrival, I found men in different groupings conversing in low tones. Immediately, the chairman called the meeting to order. However, one of the elders intervened and informed him that elders are never kept idle and therefore I had to pay a bee hive full of bees or Kshs 1000, for them to quench their thirst, I did.

The chairman called the petitioners to state his case. “Our Lords, elders of the village, I stand to represent a group of farmers who had entered this year’s cereal competition. We have noted with a lot of concern that the respondent has been winning the competition for the last four years. Despite changing the Electoral commission, he still wins. This is because he uses witch craft, money, intimidation and all sorts of tricks to rig the competition. Allow me to present exhibit SD 01, these are the seeds he buys for his neighbours which we believe he takes them to a witch doctor before. I also present exhibit SD 02, a photo of him taking tea in the village hotel with one of the

commissioners. Exhibit SD 03 is another photo of him in dark glasses with a cowboy hat pointing to one of the commissioners during the competition day. This was a sign of intimidation”.

The chairman then called me to respond to the allegations. “Our Lordship, village elders I greet you all. It is true, I buy seeds and distribute them to my neighbours whom we compete for the best cereal harvest. However, I do not take them to any witch doctor. As you all know, most cereals are cross pollinated and the only way I can attain the best harvest is by ensuring my neighbours plant quality variety to avoid cross pollination of inferior quality”.

I added, “for a start, I use trichotech and mytech to protect the seedlings from soil fungal pathogens and plant paristic nematodes. To win my battle against broadleaf weeds, I visit Corteva where I buy Ariane EC 450 WG. For nut grass, I pass through Bestfield East Africa Ltd for a dose of Patriot 750 WDG. You cannot get quality produce if you do not take care of your diseases; therefore I constantly give my cereals a royal treatment by visiting BASF for a dose of Rex Duo. This ensures good control of diseases for higher yields”.

Lastly, “I can’t always be there for my crop but Prosaro can, as it delivers unrivalled disease control on *septoria* and other leaf diseases. For the powdery and yellow rust, Shafi 125 SC distributed by Juanco SPS Ltd, ensures am covered through its rapid intake and quick translocation into the plant. After taking care of my diseases, I pass through Syngenta East Africa Ltd and get a dose of Engeo 247 SC, a new insecticide for total control of sucking and chewing insect pests in wheat.

“My Lordships I kindly request my competitors to stop wasting their time in requesting for a disbanding of the Electoral Commission and invest in the above”. With those few allow me to rest my case. The elders requested for time to deliberate and make their decision. All my competitors ran to me and apologised and also requested me to buy some of the products for them. So next time when you meet PMQ 700 AM squeaking, you rest assured am serving my community.

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