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Soil Health



Regenerative agriculture is a holistic, systematic approach to farming which mimics natural processes. It is a system aimed at optimising soil and plant health and increasing soil carbon levels.

Regenerative agriculture encompasses the principles of permaculture, organic, biodynamic and biological farm practices.

The management of agricultural soils to improve their capacity to sequester and store carbon as stable humus provides significant benefits in terms of soil structure, water-holding capacity and nutrient status, helping to improve farm productivity and profitability.

Restoring the carbon levels of the planets agricultural soils provides a short-term solution to climate change whilst improving the resilience and productivity of our farming systems.

Adoption of regenerative agriculture requires a paradigm shift by farmers. Management practices require a focus on maximising the photosynthetic capacity of plants and address soil mineral and microbial balance. Soil biology must be actively managed to maintain and improve soil health and fertility.

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Masila Kanyingi
Editor



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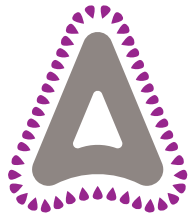
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Cereals

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Fall Armyworm Status: Impacts and control options in Africa

In the first evidence note (Fall Armyworm Status: Impacts and control options in Africa, Preliminary Evidence Note) written by CABI in April 2017, 17 countries confirmed FAW presence through official and unofficial sources. Nine more were suspected of having the pest. As this report shows however, the situation is constantly evolving.

At the time of going to press, FAW had been reported from 28 countries. These include a variety of sources including IPPC reports, ministerial declarations, peer reviewed journals, and UN affiliated organisation reports. A further nine countries have conducted or are presently conducting surveys, and either strongly suspect its presence or are awaiting official confirmation, at the time of publication. Two countries have stated that FAW is absent from the country.

The FAW is now well distributed across the African continent and national reports on the status in many countries have been

published. However, the content of information in the reports is very variable, which makes wider estimates of FAW impacts on maize yield and economics at a national level based on these sources difficult.

Economic impact

Thus, to estimate the potential impacts on yield and economics on the major maize producing countries that is likely to happen over the next few maize producing seasons assuming that the FAW will spread throughout all areas where it is predicted to survive, CABI has estimated impacts of FAW for 10 substantial maize



producing countries by extrapolating estimates of proportion of yield loss derived from a survey from Ghana and Zambia and combining this with published data on national maize production and other information for the 10 countries.

The total estimated yield and economic losses for each of the 10 countries are given in Table 1, below.

Table 1. The estimated lower and upper yield and economic losses in the 10 countries included in the study

| Country | Yield loss (lower) (tons) | Yield loss (upper) (tons) | Economic loss (lower) (US\$) | Economic loss (upper) (US\$) |
|--------------|---------------------------|---------------------------|------------------------------|------------------------------|
| Benin | 295,624 | 735,846 | 86,598,873 | 215,555,890 |
| Cameroon | 319,150 | 794,405 | 133,691,728 | 332,776,149 |
| DRC | 254,469 | 633,406 | 74,543,135 | 185,547,586 |
| Ethiopia | 1,227,226 | 3,054,727 | 292,611,698 | 728,348,682 |
| Malawi | 769,338 | 1,914,982 | 225,336,849 | 560,967,482 |
| Mozambique | 99,679 | 239,230 | 35,052,187 | 84,125,249 |
| Nigeria | 2,129,121 | 5,299,661 | 748,705,536 | 1,863,625,736 |
| Uganda | 558,873 | 1,391,109 | 163,714,186 | 407,505,962 |
| Tanzania | 1,301,250 | 3,238,980 | 381,183,053 | 948,814,338 |
| Zimbabwe | 234,764 | 584,357 | 76,689,435 | 190,890,007 |
| Total | 7,189,494 | 17,886,703 | 2,218,126,680 | 5,518,157,081 |

On this basis it can be seen that currently Benin, Malawi and Zimbabwe are most affected.

The estimates indicate that for these 10 countries taken together, the potential impact of FAW on maize yield lies between 7.2 and 17.9m tonnes per year and with losses lying between \$2,218m and \$5,518m per year. The economic losses have also been expressed as (lower and upper) percentage loss to agricultural GDP (averaged over the last three years) in Table 2, below.

Table 2. Estimated lower and upper economic losses for the 10 countries expressed as percentages of their agricultural GDP

| Country | % agricultural GDP loss (lower) | % agricultural GDP loss (upper) |
|------------|---------------------------------|---------------------------------|
| Benin | 3.93 | 9.78 |
| Cameroon | 2.00 | 4.99 |
| DRC | 1.10 | 2.75 |
| Ethiopia | 1.34 | 3.34 |
| Malawi | 12.50 | 31.12 |
| Mozambique | 2.10 | 5.00 |
| Nigeria | 0.69 | 1.72 |
| Uganda | 2.36 | 5.88 |
| Tanzania | 2.68 | 6.67 |
| Zimbabwe | 4.54 | 11.31 |

Control options

In the Americas pesticides and genetically modified (GM) crops are the main methods of control, although FAW has developed some resistance to both. Most countries in Africa do not yet plant GM crops.

Pesticides are an option in Africa, though are not always affordable to many small-scale farmers; subsidy or government-funded implementation is therefore being used in some countries.

Lower-cost mechanical and cultural control methods have yet to be proven in Africa, but could be adopted in the meantime.

Mass rearing and release of parasitoids and predators is used as an alternative in the Americas but currently costs may be prohibitive without subsidy in Africa.

Classical (introduction) biological control should be pursued immediately. Virus-based biopesticides available in the Americas may offer a low-risk option, but are not yet registered in Africa, and again may be expensive for many farmers.

In all cases a widespread communications programme is necessary to inform farmers how to monitor and identify the pest, and what management methods are available which can be selected according to local context.

In this, any direct control methods target the larvae, but two aspects of the biology pose constraints:

- Larvae are relatively inactive during the day, so treatment (e.g. spraying) is best done in the early or late part of the day
- Older larvae tend to bore into the whorl or cob (of maize), so contact pesticides are not effective unless applied when the larvae are young. Monitoring is required to detect the young larvae, and to determine whether treatment is justified.

Monitoring for treatment decision making

“Consider short term subsidies for small scale farmers, for example to reduce prices for lower risk product”.

Two approaches to monitoring are used, both of which need further investigation in Africa:

Trapping adults: Pheromone traps attract the male moths with a synthetic sex pheromone, and give an indication of the adult population in an area.

Scouting: Plants are inspected in detail, and different aspects of the damage and/or the presence or number of eggs and different sizes of larvae recorded. Different scouting protocols may be used for different crops, and times of the season. Based on the results of monitoring, a decision whether to treat can be made.

Pesticide registrations and recommendations

To be legally used for FAW control, a pesticide must be registered, requiring efficacy and toxicity data. Large numbers of pesticides are registered in the Americas; Brazil has around 40 products registered for Fall Armyworm. In the USA each state makes its own recommendations, usually by crop. However, in the Americas, resistance has developed to some types of pesticide; the risk of this can be reduced by rotating pesticides with different types of action.

In Africa registration processes exist, but can be lengthy. No pesticides are fully registered for FAW yet; in some cases emergency registration is possible. Much un-registered (and therefore technically illegal) pesticide use is occurring.

Immediate actions

Farmers need advice on what actions they can take immediately. The following are suggested, though not all are supported by evidence, and they should be adjusted when more evidence is available on alternatives to pesticides and how agronomic practices can reduce risk/damage.

- Monitor susceptible crops at least weekly, with the aim of detecting egg masses and/or young larvae. Large scale farms could consider using pheromone traps for monitoring but visual inspection is also advised.
- On detecting FAW or early damage (windowing of leaves) consider treatment:
 - *Small farms*, depending on resource availability: Handpicking; placing sand/soil mixed with ash/lime into the whorl; pesticide application. Give priority to damaged plants but treat whole field if possible.
 - *Large farms*: Pesticide application to affected fields
- o *Pesticides*: Use WHO Class 3 or U if possible (though lower risk products tend to be more expensive), from a nationally recommended list. Use personal protective equipment and follow manufacturer's instructions.

- After treatment, continue monitoring, and consider further treatment if more young larvae appear. Continue until plants become too large to monitor/treat.

It is suggested that national authorities undertake the following steps as far as possible:

- Promote awareness of FAW, its identification, damage and control
- In consultation with agro-input suppliers, prepare and communicate a list of recommended pesticides. The pesticides should be available, and preferably already registered for the crop in which they are to be used, and/or for use on other caterpillars. Pesticides registered/recommended for FAW control in the Americas could be selected, but WHO class 1a or 1b pesticides should never be recommended (recommendations in US are for very specific uses).
- Provide emergency/temporary registration for the recommended pesticides. Registrants should provide supporting data from the Americas within a specified period.
- Arrange for laboratory efficacy tests of recommended pesticides to be conducted by authorised national laboratories.
- Regularly review recommendations and publicise changes promptly and widely.
- Consider short term subsidies for small scale farmers, for example to reduce prices for lower risk product.

A comprehensive range of actions for the short, medium and long term was identified at an international meeting organised by AGRA, FAO and CIMMYT in Nairobi in April 2017. This has subsequently been developed by FAO and partners into a framework containing 4 components:

1. FAW Management, including early warning and control methods
2. Assessment of the impact of the pest
3. Communication, information sharing and awareness raising
4. Coordination. The Nairobi meeting agreed that FAO should be responsible for overall coordination.

FAO will be publishing the final version of the framework in September, which will provide a guide for development of projects and programmes by the various stakeholders.

A

Coagen 20SC

200ml / Ha, 6-7ml/20l



B

Avaunt 150 EC

300ml / Ha, 7-8ml/20l



ANGAMIZA FALL ARMYWORM

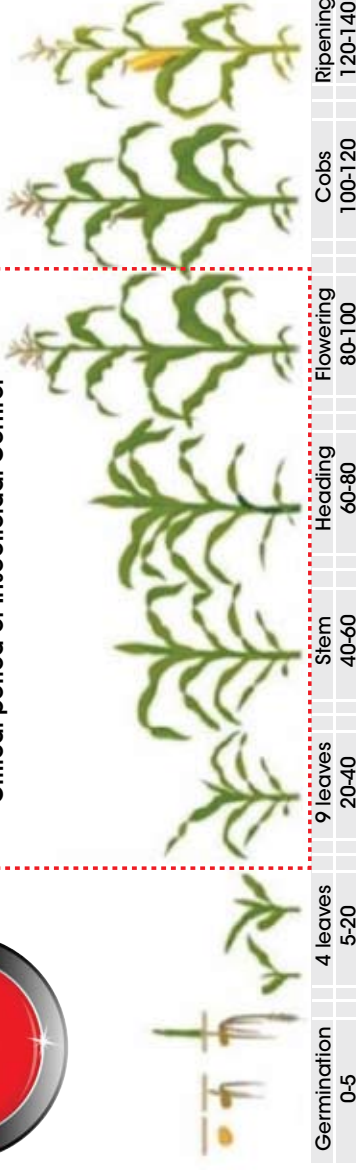


Pest Damage



Alternate between A, B, C or D to prevent pest resistance

Critical period of Insecticidal Control



C

Fastac10 EC

500ml / Ha, 40ml/20l



D

Vantex 60CS

200ml / Ha, 5-6ml/20l



Spray late evening when Fall Armyworms are most active, about 2 weeks after emergency and just before tasseling.

Sustainable agriculture to fight climate change and involuntary migration



FAO and IOM call for renewed focus on rural development and sustainable agriculture to mitigate climate disasters that are displacing one person every second

Climate change poses a major risk for rural people in developing countries, often leading to distress-driven migration, and bolstering sustainable agriculture is an essential part of an effective policy response, FAO director-general José Graziano da Silva said.

Graziano da Silva cited figures showing that since 2008 one person has been displaced every second by climate and weather disasters – an average of 26mn a year. He pointed out that the trend is likely to intensify in the immediate future as rural areas struggle to cope with warmer weather and more erratic rainfall. The solution to this challenge lies in bolstering the economic activities that the vast majority of rural populations are already engaged in.

“Although less visible than extreme events like a hurricane, slow-onset climate change events tend to have a much greater impact

over time,” William Lacy Swing, director-general of the International Organization for Migration (IOM) said, citing the drying up over 30 years of Lake Chad, now a food crisis hotspot. “Many migrants will come from rural areas, with a potentially major impact on agricultural production and food prices.”

Graziano da Silva and William Lacy Swing spoke at a meeting during FAO’s Conference. FAO and IOM, chosen as co-chairs for 2018 of the Global Migration Group – an inter-agency group of 22 UN organisations - are collaborating on ways to tackle the root causes of migration, an increasingly pressing issue for the international community.

Farming and livestock sectors typically bear more than 80 per cent of the damage and losses caused by drought, underscoring how agriculture stands to be a primary victim of climate change. Other impacts include soil degradation, water scarcity and depletion of natural resources.

Agricultural and rural development must be an integral part of solutions to weather and climate-related challenges, especially as they link with distress migration, Graziano da Silva said. Investment in resilient rural livelihoods, decent employment opportunities, especially for youth, and social protection schemes geared to protecting people from risks and shocks, is necessary, he added.

FAO also helps vulnerable members states in various ways, including with setting up early warning and early actions systems, dealing with water scarcity and introducing Climate-Smart Agriculture methods and Safe Access to Fuel and Energy initiatives designed to ease tensions between refugees and their host communities as well as reduce deforestation





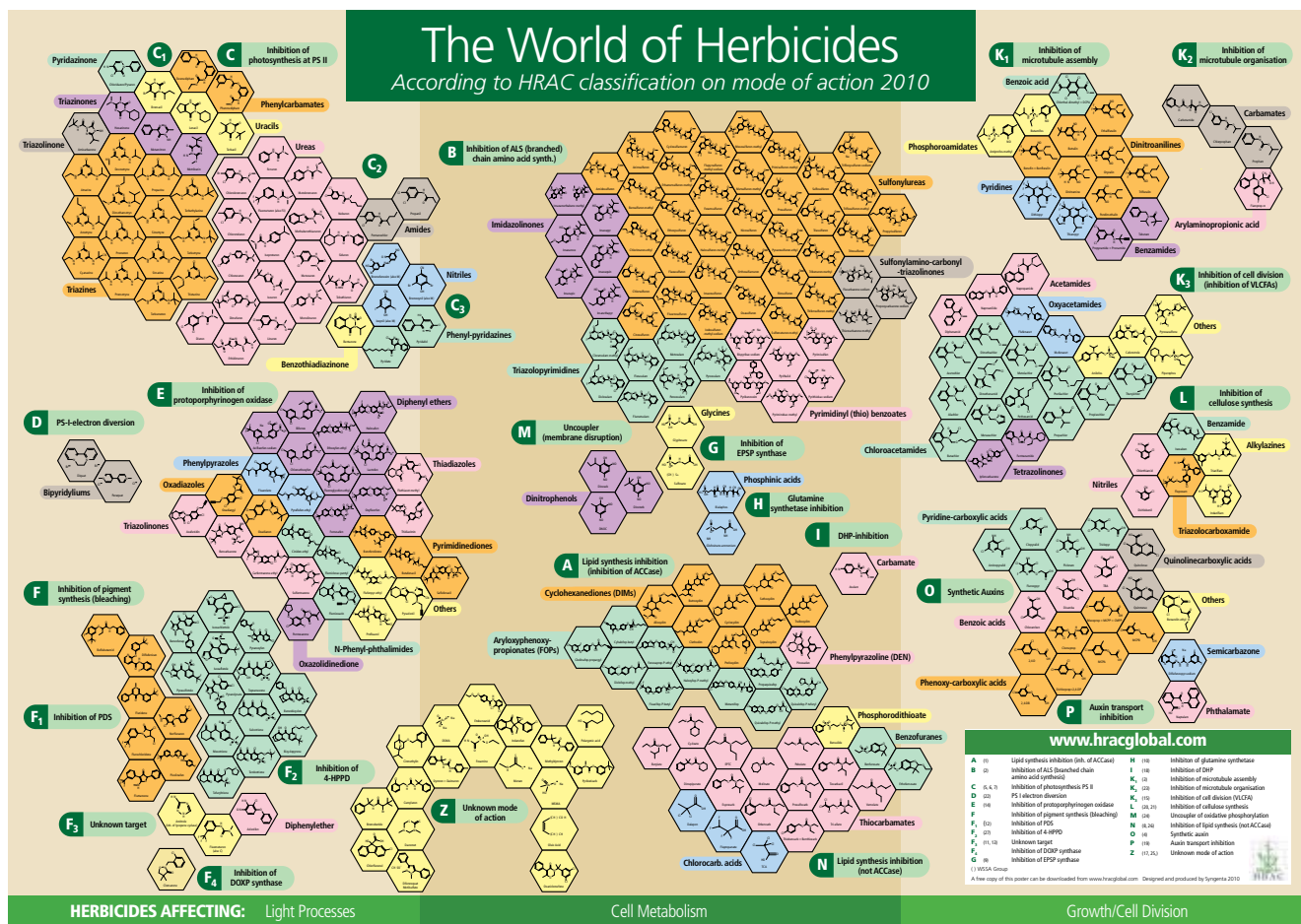
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Herbicide Resistance is Certainly Manageable!



“Doing the same thing over and over and expecting a different result” is often quoted as Einstein’s definition of insanity. It could easily be argued that is exactly the practice that farmers and agronomists have found themselves following in recent years. This is because herbicides in the past were highly effective, cheap and easy to use. But reliance on herbicides alone has contributed to the widespread herbicide resistance problems that we are seeing today. If you look at the problem simply, herbicide resistance is nature’s way of telling us herbicides alone are not sustainable and introducing more diverse weed control methods is required to disrupt the weed’s life cycle.

How farmers and agronomists were dealing with the challenge of herbicide resistant weeds and discussing how to manage herbicide-resistant weeds. Farmers and agronomists are actively looking for better ways of dealing

with herbicide resistance, with the momentum moving to more cultural controls of weeds rather than relying on synthetic chemistry. This is particularly important since no new herbicidal mode of action has been discovered for over 20 years, and even if a new mode of action was discovered today it would take many years to work its way through the regulatory process before reaching the market.

There is need for effective communication when it comes to talking about herbicide resistance.

This starts with effectively communicating new research on herbicide resistance in a format that farmers and agronomists can understand, right through to ‘farmer to farmer’ discussion groups where sharing and finding solutions as a collective is really working.

To put it simply: herbicide resistance is a

problem that is not going to go away, but it is certainly manageable!

Herbicides and resistance

The accepted definition of herbicide resistance is the one given by the Global Herbicide Resistance Committee, which is:

“Herbicide resistance is the ability of a weed biotype to survive an herbicide application, where under normal circumstances that herbicide applied at the recommended rate would kill the weed. In contrast, plant tolerance to a particular herbicide is the inherent ability of that plant species to survive and reproduce after treatment with that herbicide.”

Herbicide resistance is broadly broken down into two groups: target site resistance and non-target site resistance. Herbicides work by binding onto enzymes and inhibit the



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|--|------------------------|-----------------------|
| When weeds are actively growing but 3 - 21 days before planting depending on the crop type | 2.5 L in 400L of water | 125 mL |



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metabolic process within the plant, leading to death. In target site resistance the binding site within the plant has been altered by mutations meaning that the herbicide can no longer bind to the enzyme and will lead to the plant surviving. Target site resistance is a total resistance and affects herbicides that are in the same chemical group. All other forms of herbicide resistance fall into non-target site resistance, and this most commonly comes into a group known as enhanced metabolism resistance, which is where the plant can detoxify the herbicide faster than it reaches the target site within the plant.

Herbicide resistance

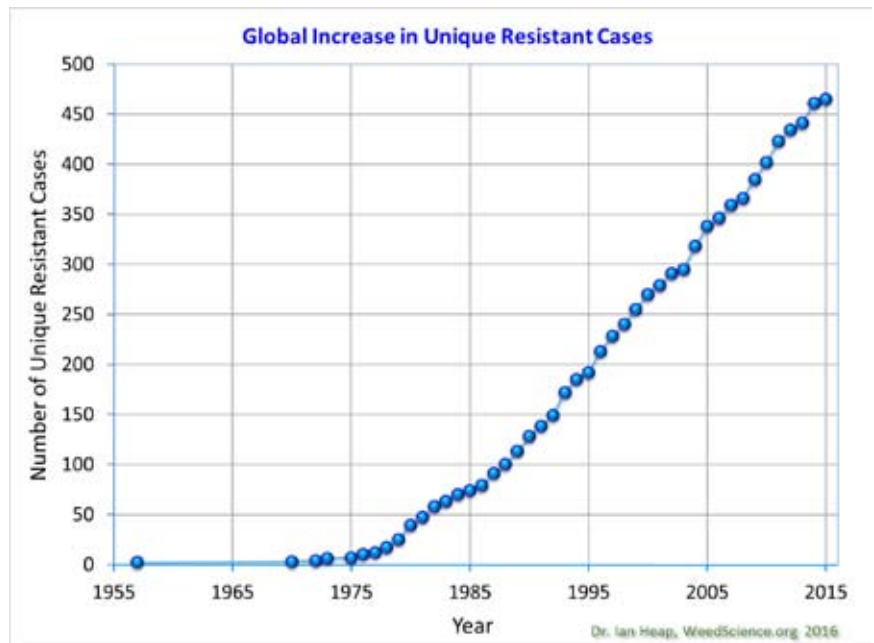
Although herbicide resistance is predominantly in grass weeds, the three broadleaf weeds should not be ignored since herbicide resistance in the broadleaf weeds is almost entirely down to relying on the same mode of action at reduced rates year on year.

Resistance testing

The benefits of herbicide resistance testing are obvious. Without testing for resistance to herbicides then you can never be 100% sure that you have resistance. Inadequate control of weeds from a herbicide can come from a number of factors involving poor sprayer set up, and can include: water volume, coarseness of spray, sprayer speed and boom height. Climatic factors also come into play, such as: temperature, soil moisture and speed of weed growth and growth stage.

These are just a few examples of what can lead to poor control from a herbicide and only by properly testing for herbicide resistance can you discount external factors and actually confirm herbicide resistance. Some of the benefits from testing are that you can find out which herbicides should still give a good level of control, thereby preventing unnecessary herbicide applications.

Another good reason is to monitor the resistance situation within a field, or as a quick reference when taking on a new block of land. Some of the reasons given for not resistance testing include: cost, difficulty or time required to collect a sample.



So What?

The overwhelming message I've heard time and time again is: 'Diversity, diversity, diversity' - the more things you can change the better! The fascinating thing about nature is its ability to take advantage of things staying the same, so if you keep changing your farming practice by constantly 'mixing it up' then it cannot adapt quickly enough to the new environment that has been created.

Cultural diversity is probably where there will be more immediate gains. Some of the more implementable cultural controls probably include:

- **Make a plan, but be flexible**

If you have made a plan then you have taken the first step in 'owning the problem' since herbicide resistance does not go away if ignored. It will only get worse. Also by thinking about fields in isolation you can work your way back to the root of the problem and think of the most appropriate solutions. Be prepared to change the plan if necessary but be patient at the same time because reducing a weed population can be a slow process.

- **Soil health and cultivations**

Healthy soils that are well drained and have higher organic matter contents give you so many more options with cultivations, cropping, etc. Go back to basics ensuring drainage

schemes are working and if mole ploughing would be appropriate or would help.

Consider what cultivations are appropriate or if they are appropriate at all! Ploughing is a great method of weed control, but it cannot be done on too regular a basis otherwise you just end up mixing all the seeds throughout the soil profile. Ploughing is also a very skilled job and modern ploughs often don't do a really good job of inversion. Other cultivations should be kept as shallow as possible with all drilling operations being as low-disturbance as possible.

On land clear of weeds, or in years of good weed control, no-till should be maximised so as not to bring fresh weeds to the surface.

- **Attention to detail**

Factor the implications of weed control into all your farming decisions. Time spent rouging weeds is very well spent if the population is low enough to allow, also taking the time cleaning down cultivator and combines in field gateways is often time well spent.

Finally, don't undervalue what a difference really good communication can make and despite this new 'posttruth' age we now live in it's reassuring to know that farmers still trust farmers.

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Seed treatment

Treat the seed directly before planting. The treatment of the seed can be done with an automatic seed treatment machine, with a cement mixer or with a rotating drum. Fill the drum not more than two thirds of its volume with seed. With the drum rotating slowly, apply nhance at the recommended rate of 100ml per 10 kilo seed to ensure good coverage of the product on each seed.

Rotate the drum until the product has dried on the seed (3-5 minutes). Do not mix the seed longer than is needed. Do not expose treated seed to direct sunlight.

Note: Ensure that the seed is completely dry before planting. Calibrate the planter with treated seed before use.

Directions for use

Use as a single treatment on the seed or in combination with microbiological inoculants, fungicides or insecticides. Treat seed only for planting purposes. Do not use treated seed for human or animal consumption.

Dosage: Use nhance at a rate of 100ml per 10 kilo of seed

Treatment at planting

This treatment can be done with a mounted applicator unit on the planter. Calibrate the applicator to ensure that the required dosage is achieved. Apply nhance at a rate of 100ml per 10 kilo seed, diluted in the required amount of water per hectare, directly onto the seeds in the planting furrow before the seed is covered with soil at planting.

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nhance is manufactured from freshly harvested seaweed with addition of micronutrients using a unique process that does not involve the use of chemicals, freezing, heat or dehydration. This "cell burst" technique ensures that the delicate growth regulators are released in their active form. nhance should be used in addition to your normal fertilisation program.

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Barley Farming

Evolutionary Survivor

The government should offer support in terms of financing, machinery, subsidize fertilizer and seeds for barley farmers. These will encourage farmers to do it as a business where they are assured of return on investment, provide employment to youths and improve our exports which in turn improves our foreign exchange. Mr. Thomas Kipkorir, the Country Manager. Crop Protection and Public Health Business at BASF has worked with barley farmers for long. In a conversation with Cereals Magazine, he shared his experience.

Discuss barley farming globally and Kenya.

Barley is a member of the grass family and is a major cereal grain. Important uses of Barley include animal fodder, source of fermentable material for beer and certain distilled beverages, and as a component of various health foods.

The grains are commonly made into malt in a traditional and ancient method of preparation. Based on global FAO statistics for 2000-2012, barley (*Hordeum vulgare* L.) is, after maize, rice and wheat, the fourth most produced grain on an approximate dry weight basis (FAOSTAT, 2014). Global barley volume has remained largely stable at approximately 150 million tonnes/year between 2000 and 2012 (versus maize which has increased from 600M to just under 900M tonnes). Although it does not tolerate highly humid warm climates, it is an adaptable cereal that has a growing range that extends from the sub-Arctic to upland areas of the subtropics. This suggests a gene pool of different varieties for wide environmental adaptability and good stress resistance (Cattivelli et al., 2011).

Discuss the conditions favouring barley

The most common malting barley varieties used in Kenya are Fanaka, Cocktail, Quench, Sabini and Nguzo. Although the latter two are currently being phased out as they are older varieties with lower yields, it is recommended that seed samples be preserved in the interest of retaining this element of species biodiversity.

farming in Kenya

Barley has good drought, cold, and salt tolerance and is generally produced in temperate and semiarid subtropical climates. Barley production occurs at higher latitudes and altitudes and closer to the limits of deserts than any other cereal crop, i.e. barley is generally produced under conditions of moderate water stress. Ideal growth conditions are well-drained

loam soils, at moderate rainfall (400 – 800 mm) or under irrigation, and at moderate temperature regimes (15 – 30 °C) (Jaetzold, 2006a, Ullrich, 2011). Environmental abiotic stress factors that can cause severe grain losses are often caused by high or low temperatures, drought, anaerobiosis (i.e. the absence of oxygen in the soil), and soil anomalies such as excess salt. Such abiotic stresses often occur simultaneously, for example, drought (i.e. water availability below that required for maximum crop yield) is often associated with the occurrence of high temperatures. Soil salinity and soil sodicity are common problems in arid and semiarid areas, therefore barley varieties grown in these marginal areas have to be tolerant to soil salinity (Cattivelli et al., 2011). Although barley tends to be better suited to higher altitudes, there is a fine balance between suitability and productivity. Rain tends to start earlier at higher altitudes, but growing periods lengthen at higher altitudes because the production of biomass is slower in cooler altitudinal climates. Therefore, the chances of a crop ripening before the end of the rainy season becomes smaller in the higher belts (Jaetzold, 2005). This balance is affected when climate change causes

temperature rises along the altitudinal belts.

How can you compare barley farming and production in Kenya with other global barley farming giants?

Global production is approximately 2 t/ha (e.g. Australia) to more than 7 t/ha (e.g. the United Kingdom) (Ullrich, 2011). FAOSTAT reports an average barley yield for 2000-2012 in Kenya of 3 t/ha, however, EABL records between 2010 and 2014 show an average of 2 t/ha. Typically, country yield averages, hectareage, and total production reflect relative growing conditions (mainly related to precipitation) and management technology (mainly soil fertility and pest management) (Ullrich, 2011).

Discuss land preparation, main varieties planted, weeds, crop nutrition and general crop production

Barley is a widely adaptable crop. It is currently popular in temperate areas where it is grown as a summer crop and tropical areas where it is sown as a winter crop. Its germination time is one to three days and grows under cool conditions. It is more tolerant of soil salinity than wheat, and has a short growing season and is also relatively drought tolerant. The most common malting barley varieties used in Kenya are Fanaka, Cocktail, Quench, Sabini and Nguzo.

Although the latter two are currently being phased out as they are older varieties with lower yields, it is recommended that seed samples be preserved in the interest of retaining this element of species biodiversity. Cocktail and Quench perform well at high altitude areas with a longer growth period, while the other varieties can be grown in different regions if the timing of planting is done well. The potential yield for many of these varieties is as high as 6 t/ha, but currently, in Kenya, average yield is approximately 2 t/ha.

The barley growing season depends on the onset of rainfall, with the main rainfall season stretching from February to October. Ninety percent of barley is planted

“An estimate of total land area suitable for barley growing in Kenya, taking into account geographical features and climate there is significantly more suitable land present than is currently in production for barley. At present, only about 20,000 hectares is under barley in Kenya”.

after the first rains of the season, with a small amount of barley in Timau planted “dry”. Most barley production areas in Kenya have a mid and late planting season, with only Timau and Kinangop having two planting seasons due to the availability of rainfall.

Discuss diseases, scouting, disease management and general crop protection.

Powdery mildew

Powdery mildew is often present in susceptible varieties, but generally causes only relatively small yield loss.

Control: - seed and fertilizer treatments can give good early season control of powdery mildew and use of resistant barley varieties.

Leaf rust and stem rust

Leaf rust and stem rust are the major air-borne diseases of barley. They are more likely to occur in wetter seasons or in higher rainfall areas. Both can cause significant yield loss and quality downgrading.

Control: - Planting

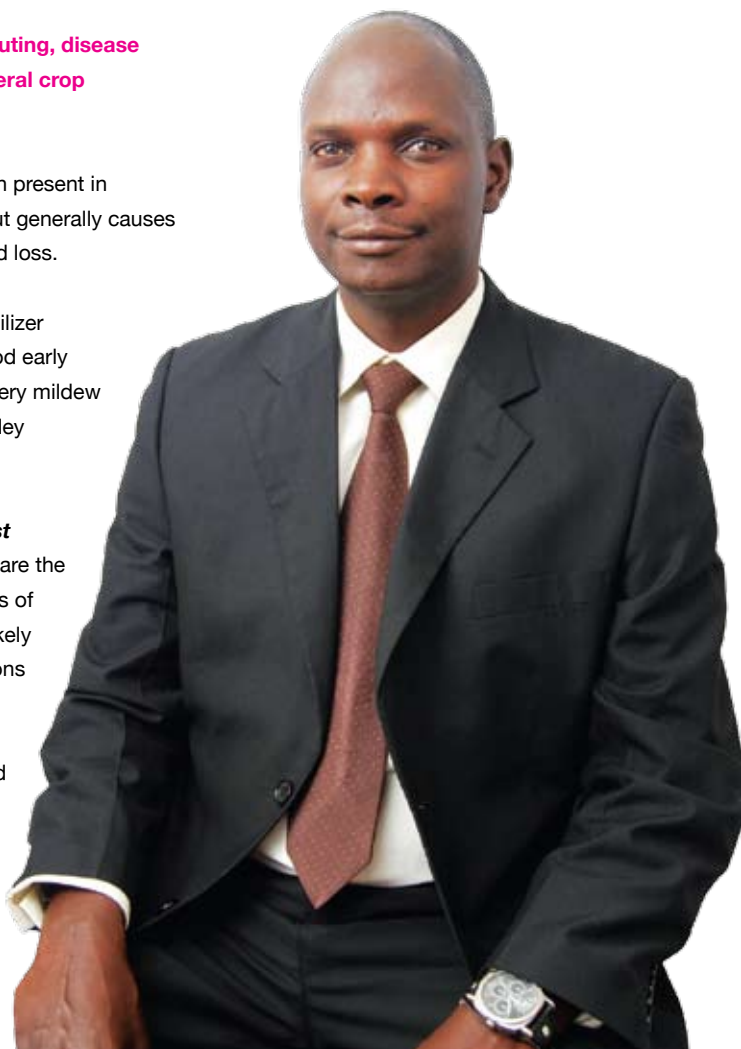
resistant varieties and avoidance of very early or very late plantings are the best protection against rusts

Head blight

Head blight in barley may be caused by several species of fungus. Damage can range from death of single florets to loss of the whole head. The fungi responsible are stubble borne and infection is favored by extended wet conditions at and shortly after head emergence.

Highlight barley production and general management

- Select a suitable variety. Leaf rust, net blotches and powdery mildew are the more important diseases for which selection of resistant varieties can improve performance and reliability.
- Treat seed with appropriate fungicidal dressing as smuts and net blotch may be



Mr. Thomas Kipkorir



Mr. David Kilesi, Chairman Barley Association and a prominent Narok Farmer

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seed borne.

- Plant in good soil moisture and with the correct plant population.
- Use adequate nitrogen fertilizer but do not over fertilize as this will encourage excessive vegetative growth and could result in lodging.
- Carry out crop rotations and soil test to have adequate nutrition.
- Inspect crop regularly for insect infestations and foliar diseases and use appropriate control methods.

Discuss harvesting and post harvest handling

Barley has matured when it's golden in color and brittle. If the barley is for malting purpose (for beer, other alcohol and malted foods), or it involves mass production advanced tools are to be used. For human food, cut the barley plants manually. Harvesting is generally done by combine harvester. Harvesting time of barley

‘ Although it does not tolerate highly humid warm climates, it is an adaptable cereal that has a growing range that extends from the sub-Arctic to upland areas of the subtropics. This suggests a gene pool of different varieties for wide environmental adaptability and good stress resistance .

depends on the time of sowing, cropping period and maturity. Barley is more prone to shattering. So, in order to reduce this type of loss, barley crop should be harvested before being fully matured and in the morning hours.

What are the current challenges facing barley farmers in Kenya

Lack of credit facility to get inputs and finance other farm operations. The greatest challenge is market prices coupled with tough conditions to be met especially with standard quality i.e. Nitrogen levels. Unreliable rainfall remains the biggest

challenge to barley production, specifically drought after germination and excessive rainfall during harvesting

Discuss the current acreage, production per acre and country production

An estimate of total land area suitable for barley growing in Kenya, taking into account elevation, slope, absence of protected areas and applying climate change scenarios reveals that there is significantly more suitable land present than is currently in production for barley. At present, only about 20,000 hectares is under barley in Kenya.

Not all barley is used for brewing, any idea of the varieties for brewing and quantity used in brewing? What are the other uses?

When harvested, only approximately 60% is of sufficient quality to be used as malting barley. Approximately 30% is used as adjunct barley (used in the brewing process with the addition of enzymes) while approximately 5-7% is used as feed barley.

Beverages: Alcoholic beverages. A large part of the remainder is used for malting, for which barley is the best-suited grain. It is a key ingredient in beer and whisky production.

Non-alcoholic beverages. On-alcoholic drinks such as barley water and barley tea have been made by boiling barley in water. In Italy, barley is also sometimes used as coffee substitute, which is obtained from ground, roasted barley and it is prepared as an espresso (it can be prepared using percolators or filter machines). Nowadays, it is experiencing a revival and it is considered by some as an alternative to coffee when, for health reasons, caffeine drinks are not recommended.

Some of the farmers are exporting barley to the neighbouring countries, any idea of the export data? Do you think Kenya can become a regional leader in barley production?

Farmers hope to take advantage of the East African Community's five-year Food



Security Action Plan, which allows the movement of food and trade from areas of surplus to areas of deficit in the region, I don't have an exact data but approximately 25% of barley produced here finds its way out of Kenya. Kenya has the potential to lead in production if and when the challenges I stated above are met.

Comparing with other global producers, what should Kenyan barley farmers improve on to be competitive regionally and globally?

The farmers are supposed to form an association and pool together in one direction for support and marketing of barley.

EABL is currently investing in sorghum, is this having any impact to barley farmers

Farmers are hopeful that technology

can help boost the livelihoods of poor farmers who are jumping on the sorghum bandwagon. They say that yields could be as high as eight tonnes per hectare if the quality of sorghum seeds is improved.

The scheme aims to help reduce food insecurity and poverty by supporting the production of sorghum for a variety of uses in ten districts of Kenya's Eastern Province as well as parts of Tanzania.

As part of the project, farmers will be instructed in sustainable sorghum production, given access to seeds of improved sorghum varieties, and helped in establishing links to markets. Most of the farmers are selling their sorghum locally to East Africa Breweries, but they are ready for the prospect of markets opening further afield. As barley crops dwindle and production of drought-tolerant sorghum

increases. This means farmers will opt to go for Sorghum in place of barley hence reduce area under barley production.

Why and how should the government support barley farmers.

The government should offer support in terms of financing, machinery, subsidize fertilizer and seeds for barley farmers. These will encourage farmers to do it as a business where they are assured of return on investment, provide employment to youths and improve our exports which in turn improves our foreign exchange.

Any other comments?

There is potential to compensate for loss of land suitability through increased yields per unit area (plant breeding and improved cultivation methods), in the coming years, although historically, yields across Kenya have shown no increase over time.



Barley: A Major Cereal Grain

By David Mulandi

Barley, *Hordeum vulgare* L is a major cereal grain and a member of the grass family. It is among the major grains by quantity produced behind corn, Rice and wheat. Barley is mainly used in malting, Animal feed and food for human consumption

Background

In the grasslands where people liked to live, barley grew wild, and people gathered it to eat boiled or ground into flour and baked when it came ripe every spring. People first began to farm barley (instead of picking it wild) around 11,000 BC in West Asia, possibly because of a climate change that made the world hotter and drier.

Barley farming spread south from West Asia to Egypt and North Africa around 8500 BC and to Sudan by about 5000 BC. Barley also spread to Greece and Italy about 7000 BC, and reached northern Europe about 5000 BC, travelling along the Danube and Volga rivers. Barley reached India by about 6000 BC, and got to China about 3000 BC. By about 1000 BC, people were farming barley in Korea, and by 500 AD Tibetan people were also eating a lot of barley. Barley reached Ethiopia about 500 BC, and West Africa in the Middle Ages. The Dutch brought barley to South Africa in the late 1650s.

British settlers brought barley to the Americas in the 1600s AD in order to make beer, but they ate mostly wheat and oats. Spanish traders brought barley to South America, Mexico, and California. Settlers introduced barley to the rest of the world.

Ideal Growing conditions

Compared to wheat, barley has a better drought, salt and cold tolerance and grows well in temperate and semiarid subtropical climates. Soils with a pH of 6.5-8.0 and of medium texture are ideal for the cultivation of

barley.

The crop requires well-drained loam soils with moderate rainfall of between 400-800 mm or irrigated and with a moderate temperature of between 15-30°C. Anaerobism (lack of oxygen in the soil), low or high temperatures and drought lead to severe grain losses.

Growing areas in Kenya

Barley is majorly grown in Mt Kenya Region, Narok, North Rift and Naivasha

Agronomic Practices

propagation: Barley is propagated by seeds. It is highly advisable to use certified seeds for the following reasons:

- Certified seed does not contain weed seeds such as wild oats, *Setaria* spp., Rye, Browe, Beckeropsis and grasses.
- It has good germination because it contains sound kernels - neither broken nor cracked.
- Are of one variety to ensure even ripening and uniformity of the crop.

Fertilization: Owing to the greater tendency of barley to lodge, as compared with wheat, stem stabilizers are being used in intensive growing systems. Potassium silicate is recommended to prevent lodging of the crop.

The use of fertilizer in barley farming depends on the soil use practices used by the grower and the previous fertilizer use on the same piece of land. Soil tests are highly recommended for accurate fertilizer application.

Establishment: Nitrogen is required for rapid early growth. Phosphate is needed to supply energy for early growth and development especially for gaining significant root mass.

Tillering: Nitrogen is important for leaf development and size and for increasing the number of tillers per plant. Manganese is essential for the structure of proteins and enzymes that help in the photosynthesis.

Stem extension: Nitrogen for rapid growth and germination and large leaves. Phosphate for energy needed for growth and development Potassium is needed for structural strength and water regulation. Sulfur is a vital part of plant proteins, and certain plant hormones. Zinc for internode elongation, formation of enzymes and hormones.

Flag leaf and grain filling: Nitrogen for higher yields through green leaf duration, grain site survival, grain size and protein levels. Magnesium for green leaf duration. Phosphate for dry for yield improvements through remobilization of dry matter Boron improves pollen viability for better fertilization.

Pests and diseases

Notable insect pests affecting barley include: Barley Thrips. Cereal leaf beetle, Grasshoppers, Wheat stem sawfly and Wireworms. Main diseases are, Stripe rust, Smut, Septoria, Ergot, Fusarium Head Blight and Leaf Rust

Weed control

Like all cereals, barley requires a weed free growing environment. Use of pre-emergence and post-emergence herbicides is very important in the cultivation of the crop because it is extensively affected by broadleaved weeds and annual grasses.

David Mulandi

Agronomist Amiran Kenya Ltd.

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Boom Or Doom!

Future Of Cereal Farming In Narok

By Doris Kawira



A Crop Field in Narok

The future of cereal farming in Narok is not looking good because of the challenges the stakeholders in this sector are facing. Narok is part of the Arid and Semi-Arid lands (ASALs) that cover 80% of Kenya's landmass. The area is home to pastoralists who form 20% of Kenyan population and they occupy 74% of the ASALs.



Over the years, patterns of land use have changed in the ASAL from principally, nomadic pastoralism to sedentary pastoral and agro pastoral production, or to pure cultivation. Vast areas of those lands are experiencing some degree of unprecedented population growth, excessive cropping pressure and overgrazing.

Overgrazing followed by mono-cropping for the last 30 years has caused a negative impact on vegetation resources and biodiversity. The productivity, carrying capacity and soil fertility in this case have adversely been affected and in extreme cases leading to desertification.

Recent interventions such as land privatization and appropriation, to create ranching schemes or to give room to cropping have not been successful.

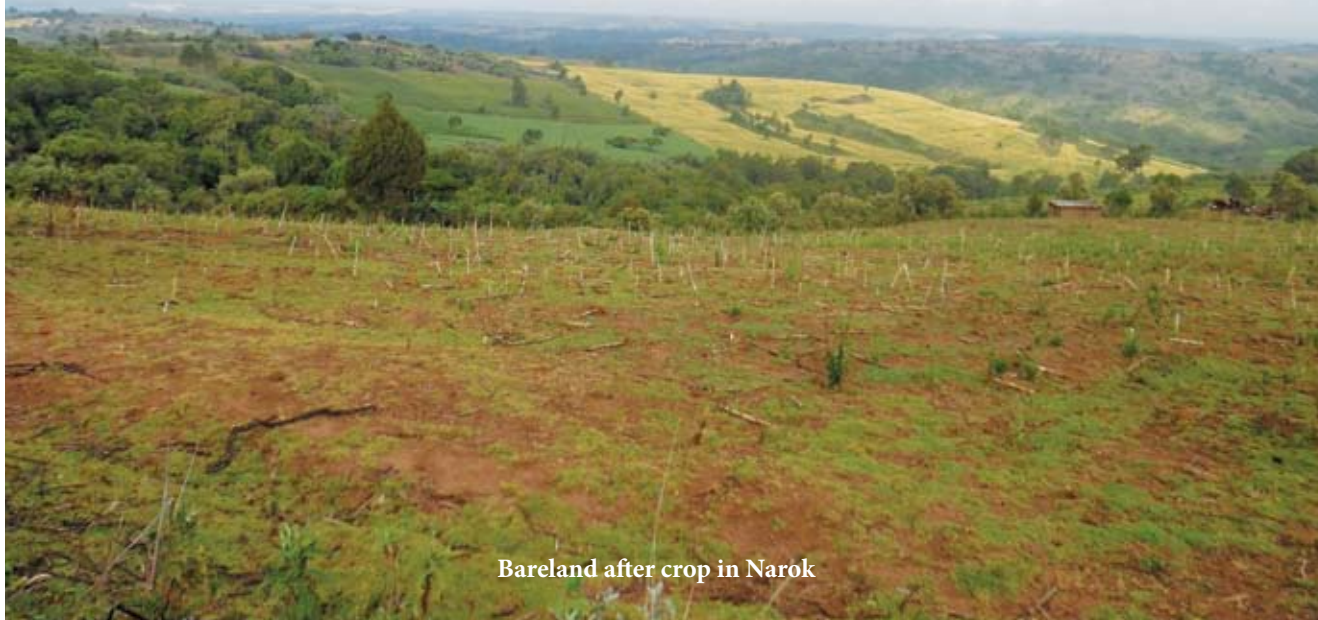
Cereals including wheat, barley and Maize have been grown in Narok for the last 30 years during which farming has gone through a lot of technology revolution to keep this farming going.

New seed varieties of the above cereal crops have been developed to adapt to the climatic conditions of the area ensuring good productivity. Agrochemical companies have also invested millions of Dollars in research, registration, development and launching of agro-chemicals that can assist the farmers in the control of weeds,

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Bareland after crop in Narok

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diseases and Insects; more so protect their yields.

Farmers on their side have put all they have into the programs to ensure the timing is just right so they don't miss out on the rainy season. Over the years, challenges have emerged due to changing weather patterns and deterioration of soil due to overgrazing and mono-cropping. This has led to unsustainable productivity hence leading to low returns for the farmers and forcing farmers to abandon cereal farming or to reduce land acreage and/or push to adapt or invest on new technologies that can help them cope with the challenges for a while which has come with a huge cost .

Over these years the cost of production has increased drastically and the opposite has happened to the production of the crops per acre leading to unsustainable Return on Investment (ROI).

However, the land tenure system in Narok land which is a one season leasing concept hasn't made it easier for farmers to have an option of investing on improving the soil

Overgrazing followed by mono-cropping for the last 30 years has caused a negative impact on vegetation resources and biodiversity. The productivity, carrying capacity and soil fertility in this case have adversely been affected and in extreme cases leading to desertification.

fertility. Soil fertility is key to sustainable productivity and requires a long time investment to build and improve. The short term lease period system has led to mono-cropping as the farmers try to maximize with one season so as to get good returns. There is no room for crop rotation, liming or organic matter build up.

With low soil fertility it has seen farmer increasing the rate of inputs including fertilizers over the years to achieve same yields or sometime even lower yield than expected.

Narok area usually receives an annual rainfall of 600-1000mm, which would be enough to grow a good crop. The biggest challenge has been change of weather patterns especially when the rains come off season .This unpredictable rainfall pattern has brought a lot of uncertainty to the farmers calendar and planning of farming programs has become difficult .

With the unstable economic situation in Kenya currently the cost of credit both from the financial institutions and chemical companies is becoming too high for the farmer to bear and for stakeholders to support.

A major revolution is needed to ensure the future of cereal farming is secured.

Policies to change the Land tenure system to a long lease along with establishment of ranching systems or grazing fallows can help farmers long term investment into soil fertility improvement through right farming practices. Planting of trees is another project that the county government of Narok should start to create more forest cover hence help alleviate the effects of climate change.



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Existing Soil Constraints VS Wheat/Barley in Narok

By Benson Kibiru

Narok is one among the big grain baskets in Kenya. Wheat, maize and barley are among the major cash crops grown in the area. Production of the above mentioned crops is in medium to large scale and rainfed. However, over the years, yield realized in tonnes per hectare (t/ha or bags/ha) varies with farmers despite replication of similar practices. As per the farmers growing wheat and barley in the area, yield vary from one farmer to another which means existence of an imperative scenario. Some people have suggested that this may be attributed to different crop husbandry and soil fertility management practices. Most commonly mentioned factors include: land tenure system, type of seed, soil correction where applicable and proper use of fertilizer in terms of composition, rates of application and timing.

In trying to understand factors causing dwindling/varying yields, farmers and other interested parties have employed tools to precisely identify the major contributing factors. Soil testing is the key to accurate and precise use of fertilizer. The tool seeks to reveal soil chemical, biological and physical characteristics from which useful information is deduced and the best management practices (BMPs) are recommended.

Soil testing results in some problematic pockets in Narok have exhibited the following soil related constraints: low soil pH/strongly acidic, nutrient imbalance and deficiency/low nutrient content. Wheat and barley are not particularly

sensitive to soil acidity. However, when the soil is strongly acidic ($\text{pH} < 4.8$) this affects nutrient availability most especially phosphorus (P) and cause toxicity of Manganese and Aluminum. In acidic soils, the applied P form in soluble complex compound with Fe & Al oxides/hydroxides making it unavailable for uptake by the crop. Solubility of Manganese (Mn) and Aluminum (Al) in the soil increase with



decrease in soil pH. Thus, these elements eventually become toxic to the plant roots causing a decline in crop growth. Aluminum toxicity is a major limiting factor of barley production in acidic soils.

Continuous cropping with little or no replenishment of the removed nutrients lead to soil depletion. Worth noting, different crops remove different amounts of essential nutrients. This together with other unquantifiable loss of nutrients cause their imbalance in the soil system. Some of the established nutrient imbalance include: high percent exchangeable potassium and sodium in relation to other essential cations Calcium (Ca^{++}) and Magnesium (Mg^{++}). High percent exchangeable potassium (%EPP) induce deficiencies in Mg and

Boron (B) while high percent sodium affects the integrity of soil aggregation.

The cumulative effect of the above mentioned has significant influence on crop growth. This is through developing the following attributes in our natural soil system: poor aeration in the root zone, water movement, moisture distribution in the ploughed soil layer, reduced microbial population among others. The result in the eyes of the farmer is reduced yield which has rendered production of these crops unprofitable and hence abandonment of the economic activity.

Worth noting, most soil correction practices are expensive and the benefits are realised over a long period and therefore for the practices to be adopted land tenure system is a factor of vital importance.

An irrevocable/binding land tenure system will enhance a sustainable use of land resource.

Is the situation remediable? The answer is yes, and how? Several practices are mandatory to enhance sustainability. They include: liming of acid soils, maintaining soil organic carbon levels at desired levels ($\geq 2\%$) by returning crop residues and application of animal/compost manure in adequate amounts, crop rotation and above all farmers to make soil testing a routine practice to ensure there is early detection of existing or developing nutrient imbalance in our soil system and timely/proper correction measures are employed.

**Benson Kibiru-Lead Soil scientist/
Agronomist**

Managing for Price Stability

Farming is not just a business. There are joys and pains of the sector. Farmers put their heart and soul into their farming business. To them, it is not just a job, but rather a core foundation.

During a financial crisis working face to face with farmers is a very challenging task. Farmers take their own lives due to the economic crisis. Financial pressures of such nature may contribute towards the mental health of farmers. Financial pressure is a big burden. In light of this, it is important to further explore the area of PRM; to ensure that farmers are proactive, rather than reactive, in ensuring that their farming business is sustainably profitable.

Over the past few years, agronomists have focused on helping farmers improve productivity through good agricultural practices, farm systems and techniques to reduce costs. Financial literacy and financial well-being has also been identified as areas that need further developing and support in the industry. There are also workshops and support programmes available to help farmers improve their financial skills. While the industry has focused on improving the financial literacy, further work is required in the area of risk management.

Many older and experienced farmers are able to better cope with price volatility as they have the experience, low debt, efficiency and financial buffer to sustain them. There is need to consider the implications for the next generation of farmers who do not have this head start and are entering the industry fully exposed to the volatility of price.

Experts should assist farmers to gain a better understanding of price volatility and the tools available to them to reduce the risk on their businesses. This will contribute towards improving their overall wellbeing. PRM tools provide farmers the choice to either accept or manage price risk, thus giving them greater flexibility to manage their farms at a level of

comfort that is sustainable for them.

Sophisticated and diverse price risk management (PRM) tools are available. Farmers need to be prepared with a plan and strategies to manage price risk. PRM tools are well advanced and diverse for global requirement. These tools vary from simple forward fixed prices to a variety of flexible hedging tools. Processors, marketing companies, cooperatives, and/or financial brokers providing ease of accessibility to the tools and in depth information to help farmers utilise the tools, thus providing key competitive advantage.

These PRM solutions enable farmers transfer the price risk to someone else via a processor or a futures exchange and experience the benefits of a stable profit margin. The choice to have stable or volatile profit margins has provided some farmers with different advantages. These include enabling new farmers to enter the industry with confidence, helping some farmers to grow their businesses

These PRM solutions enable farmers to transfer the price risk to someone else via a processor or a futures exchange and experience the benefits of a stable profit margin

with certainty and others to have the ability to manage debt and achieve their goals.

The introduction of PRM tools is relatively new and options are not readily available. PRM is a developing area and the availability and flexibility of the tools will depend on farmers understanding of the tools, demand for the tools and adoption of PRM. Further support by the industry is essential. Areas of support include more PRM tools, risk management decision making tools, margin calculators and or information that will help farmers understand their price risk and make an informed PRM plan suitable for their individual situation.

A Commodity Risk and Trading Team need to be established with core focus on the development and implementation of the Guaranteed Cereal Price (GCP). This is a very contentious matter in the sector even before its implementation. The farmers concern is the creation of a division in the supply base with members receiving different prices (Those who need fixed and those who risk). Working with the Commodity Risk and Trading Team provide a greater knowledge of PRM tools and their place in the industry.

This tool that majority farmers can access to is able to manage price risk. The lack of understanding regarding the process for determining the price result in distrust in this tool and contributing to a feeling of inequality amongst the farmers and buyers. Hence, further information and support is required on PRM tool, their function and the benefits they provide individuals and the industry as a whole. PRM tools should be introduced to the sector. The conversation around GCP and there is need to critically consider PRM tools and their impacts on the industry.

Making the Most of Your Soil's Biological Potential



The underlying principle in “soil health” is that soil is a living, dynamic and ever-so-subtly changing whole environment, not just an inert, lifeless growing medium, which modern farming tends to represent. Is it then surprising that soils highly fertile from the point of view of crop productivity are also lively from a biological point of view?

For the author, this quote alludes to the degradation of soil health and the tragedy that most farmers do not fully appreciate the ability of nature to cycle nutrients. They are missing out on the benefits to their agricultural systems that flow from simply growing plants and animals which support soil biodiversity and natural cycling by returning nutrients and organic matter to the soil.

Biodiversity is essential for the survival of all species, including humans. It is the source of our foods, medicines and industrial raw materials. Our economic prosperity is dependent on it, from agriculture to tourism. Farmers have a key role in maintaining and enhancing the biodiversity on their land, while doing their best to manage pests, diseases and weeds in a sustainable way.

Regenerative agriculture (RA) is an approach to managing agro-ecosystems for improved and sustained productivity, while preserving and enhancing the resource base and

the environment. Four linked principles of regenerative agriculture which recur are:

1. Implement a continuous regime of minimum mechanical soil disturbance.
2. Maintain permanent organic soil cover.
3. Maintain a living root in the soil.
4. Plant diverse crop species in sequences and/or associations.

No Doubt

There is now no doubt that soil biology is as crucial to maintaining healthy soil function as soil chemical and physical elements. While science is proving to be both the solution and the barrier to acceptance of this basic fact as it struggles to maintain pace with discoveries in the biological world, this is changing with increasing global support. For example, in 2011, the FAO launched the Global Soil Partnership (GSP) to support sustainable management of soil resources for food security and climate change mitigation. The UN declared 2015 the International Year of Soil, a campaign to raise awareness, support policies, and promote investment toward soil security as well as enhance soil collection and monitoring. And on 4th December 2015, on the occasion of the 12th annual World Soil Day, the GSP released its first report on the state of the world's soils.

There is need to bring together all willing contributors in the public and private sectors (national governments, local and regional government, companies, trade organisations, NGOs, research facilities, and others) under the framework. The aim is to demonstrate that agriculture, and agricultural soils in particular, can play a crucial role where food security and climate change are concerned.

The questions the industry needs answered are:

1. Why is carbon so important for biological function and can we build soil carbon levels given our cropping system and tropical climate?
2. The role of soil biology in the nutrient cycle: can we influence this through management?
3. Harvesting sunlight: how can our industry make better use of what we have in abundance?
4. How can we emulate nature in our current cropping system through increasing plant diversity?

So What?

There is need to assist all farmers, wherever they are and whatever they farm, to improve soil health, profitability and environmental outcomes. Any action taken should be relevant



“Every great tragedy forms a fertile soil in which a great recovery can take root and blossom, but only if you plant the seeds.” (Steve Maraboli).

to all sectors of agriculture that rely on soil for the nutrition of their commodity. It is up to the farmer to decide and verify the best possible course of action, weighing the risks and benefits for him or herself. The most important point is that the following principles need to be applied as a system to gain the greatest potential benefit.

1 Minimise mechanical soil disturbance

There have been limited attempts to reduce tillage in the planting phase and no-till planting is still widely regarded as impossible.

2 Maintain organic soil cover

While green trash blanketing is common practice these days, the impacts of tillage or spray out of the previous crop in the fallow phase could be greatly reduced by immediate cover crop planting. Careful selection of a cover crop species mix will take into consideration the season and objectives of the cover crop.

3 Maintain living roots in the soil

Although some crops are perennial crop and maintain a living root in the soil for the duration of the crop cycle, planting a cover crop such as legumes immediately the fallow phase has started is good.

4 Greater plant diversity is better

Most crops in a healthy soil develop strong

root system with huge potential to build soil carbon levels. While multi-species fallow management once every five to six years offer potential for soil improvement. It is important to introduce plant diversity into the crop.

5 Test and evaluate soil and plant health

Comprehensive soil sampling highlights several underlying nutrient issues that need to be addressed to enable biological function and enhanced production: There is much more than the nutrient management standard that can be done as various forms of soil and crop testing become more cost effective and accurate. The onus is on the grower to fully inform themselves of the nutrient requirements for their crop and to consider that Six Easy Steps is merely the starting point for a nutrient management plan and not the end point.

6 Alleviate compaction

With the challenges of an industry reliant on large, heavy equipment expected to work in wet conditions to maintain the industry's only real attempt to address compaction to date is to move to controlled traffic farming with row and wheel spacing's matched to spraying and harvesting equipment.

Building soil organic carbon can go some way towards not only increasing water holding capacity and nutrient cycling, but also helping the soil recover after a compaction event.

7 Reduce synthetic inputs

There are several ways that growers can replace synthetic inputs with products that will either do less harm to soil biology or perhaps even assist soil biology to proliferate. For instance, replacing superphosphate with soft rock phosphate and muriate of potash with sulphate of potash, both of which are “kinder” to the soil. Regular rotation crops can reduce the amount of applied nitrogen by as much as 80% of the Six Easy Step recommendations.

In addition to the recommendations above, two further options:

Biological amendments and stimulants.

In spite of the vast array of these products available these products are very unlikely to work in isolation without first applying all of the above recommendations. Buyers need to inform themselves about each product and why it is needed.

Integrating livestock into the rotation.

This provides the opportunity for a pasture fallow, the best way to build soil carbon, but is also likely to be the most difficult scenario for change due to the need for basic infrastructure such as fencing and water facilities. For the gurus of regenerative agriculture, livestock are widely thought of as the missing link in many modern cropping enterprises.



Seeds, not Diamonds, will Make Africa Great

We have a local African saying that when you go to the stream to fetch water, your bucket will only be filled with the water that is yours. No one can take the water that is meant for you. Life will give you what you deserve, nothing more, and nothing less. But first you must walk to the stream, bend down, and dip your bucket.

African agriculture in particular has had many inspiring changes over the years. Technologies that enable farmers produce more yield per unit acreage have been developed. Access to markets and financial resources have also improved as has the policy landscape. Additionally, Africa is experiencing unprecedented economic growth with five of the world's 10 fastest growing economies being African.

However, this progress is ironical when Africa, rich as it is, is still unable to feed itself - poverty levels remain high and millions go to bed hungry. Our over-dependence on minerals is the main problem. Tragically, this immense mineral richness has not benefited the majority

Africa's future is not built on a foundation of extractive industries. These riches have not translated into wide-ranging job creation, or social welfare and stability. They have not fed hungry people. They have not reduced poverty.

Africa's economic growth is predicated upon unlocking and fully tapping into the potential of smallholder farmers who make up 70 per cent of our population. Believe it or not for many years small-scale farms are as much businesses as large-scale operations, many consider these views at best romantic and at worst foolish. Todate the concept of smallholder farms as a business has become commonplace.

Achieving the kind of economic growth that

leaves no one behind requires deliberate prioritization of the agricultural sector. In fact, agriculture is the surest path to Africa's prosperity. For instance, it is well established that GDP growth due to agriculture is at least three times more effective in reducing poverty in resource-poor, low-income countries than growth in other sectors. In sub-Saharan Africa, it is estimated to be 11 times more effective.

Africa is richly endowed with what it takes to achieve greatness - ideal climatic conditions which are, unfortunately, changing in devastating ways; large swathes of arable land; huge deposits of water that can be used for irrigation; and, most importantly, the vast potential of the people themselves especially the ingenuity and vigour of the youth. Women who do most of the farming deserve a special mention. No nation has been able to transform itself without giving women the same rights and opportunities as men.

However, achieving a continent-wide agricultural transformation, as the foundation for food security and poverty alleviation, requires visionary national and continental leadership. Africa has all it needs to succeed in the right climate of leadership.

Africa leaders' commitment to allocate at least 10 per cent of public expenditure to agriculture, and to ensuring its efficiency and effectiveness need to be lauded. A lot more still needs to be done. For instance, only eight out of 44 governments in sub-Saharan Africa have kept these promises to invest more in agriculture.

However, where the resolution has been adopted, and the will is there; where the decisions have been taken, and the actions implemented; the results have been both swift and phenomenal.

Ethiopia, for example, has reaped huge

benefits for the last two decades from visionary leadership and by honouring its development commitments. The government set up the Growth and Transformation Plan (GTP) to bolster smallholder farmers' productivity, enhance marketing systems, upgrade the participation of the private sector, increase the volume of irrigated land and curtail the number of households with inadequate food.

Today, agriculture is Ethiopia's most important sector, accounting for nearly half of the country's GDP (46.3 per cent), 90 per cent of exports and 85 per cent of the labour force.

Rwanda is another example where agricultural transformation has spanned land reform, land consolidation, and better access to inputs and extension for smallholders. This has increased the country's food availability by 150 per cent, reducing chronic malnutrition and stunting significantly, and reducing poverty by 20 per cent in the last 10 years.

Visionary leadership in agriculture, therefore, demonstrably offers rapid returns. Ethiopia and Rwanda, both among the fastest growing African economies, are good examples of countries that have walked to the stream to fill their buckets.

Other countries should make the same walk to the river of agricultural opportunities that continues flowing. The landmark African Green Revolution Forum is one step towards the river. At the Forum, global and African leaders should develop actionable plans that will move African agriculture forward.

Edited version of Dr. Kanayo Nwanze Article. He is a former IFAD president and a board member of AGRA



Set for Take off – Kenya’s Agriculture Sector Ready for Increased Investments

Our future fortunes are in the hands of our farmers and the food industry. Three out of every four Kenyans work in some aspect of agriculture. Food production and economic growth in agriculture is eleven times more effective at reducing poverty than growth in any other sector.

The importance of agriculture for Kenya and for all of Africa is now widely acknowledged and a new wave of support is rising in both the public and private sector, and among development partners and donors.

The prospect of a surge of investments for Kenyan farmers and local agribusinesses is raising expectations for the sector.

But why should anyone invest in Kenyan farms and local agriculture businesses? One answer is to be found in Kenya’s rapidly growing food retail sector. Driven by explosive demand among urban consumers, food purchases in the country are growing by an impressive 10 per cent per year and are expected to reach Sh1.8 trillion (US \$17.6 billion) by 2020. In fact, demand is exceeding domestic supply and imports now account for about half of all domestic purchases of staples like rice, wheat and soybeans.

And with the right mix of investments, Kenyan farmers could own 100 per cent of that market. For example, greater public investments in crop research and private investments in local production of high-yielding and locally adapted seeds and farm inputs could help rapidly narrow the pervasive “yield gap” on Kenyan farms. Today, most farmers harvest about two tons of maize per hectare when their counterparts elsewhere in the world get six,

We are now asking for a broad group of partners in the public and private sector to join us in seizing the moment for Kenya. Together, we can build a coalition that can accumulate and allocate the right mix of investments that will ensure agriculture becomes a powerful engine for delivering economic opportunity and food security across Kenya.

and about a half ton of beans per hectare when they could be getting 10 times that amount.

Meanwhile investments in better storage options, particularly refrigerated facilities, and transportation infrastructure can help link farmers to the markets and justify expenditures and loans for high-yield crop varieties and quality inputs.

In addition, investments can take advantage of many positive developments in the Kenyan agriculture sector. For example, over the last 15 years, yields of bananas, mangoes, and potatoes have more than doubled, making them among the most valuable crops locally and opening up business opportunities in both domestic and export markets. There is already a new public/private partnership dedicated to constructing cold storage facilities in Kenya and elsewhere in East Africa that will capitalize on the potential of rising potato production by connecting millions of smallholder farms to produce markets.

Our agriculture sector also is attracting investor interest because Kenyans are increasingly recognized around the world as intensely entrepreneurial people, who naturally gravitate toward innovation. For example, Safaricom’s MPesa money transfer system is more efficient and more widely used than consumer electronic payment systems in the United States and

Europe. Many people rightly believe we can bring that same kind of innovative thinking to agriculture.

But effectively channelling the new resources now becoming available for Kenyan agriculture requires achieving consensus on a detailed investment roadmap. It must inspire confidence in the public and private sector, and in donor countries and international institutions, that generous commitments to agriculture will generate the progress Kenyans need and deserve.

The agriculture investment forum went a long way toward finalizing a new National Agriculture Investment Plan for Kenya that can attract widespread support. Many of us involved in the meeting felt it embraced the “seize the moment” theme of last year’s AGRAF by infusing Kenya’s agriculture agenda with a sense of purpose and urgency. We are now asking for a broad group of partners in the public and private sector to join us in seizing the moment for Kenya. Together, we can build a coalition that can accumulate and allocate the right mix of investments that will ensure agriculture becomes a powerful engine for delivering economic opportunity and food security across Kenya.

Hon. Willy Bett is the Cabinet Secretary in the Ministry of Agriculture, Livestock and Fisheries in Kenya.

African agriculture: who will own the future?

Agriculture is instrumental in Kenya's poverty: it must also be instrumental in its wealth. Only through agricultural regeneration can growth, diversification and job creation occur for African economies, for no region of the world has ever industrialised without the agricultural sector being first transformed.

In short, the future of Kenya depends on agriculture. But Kenya cannot develop quickly if farming remains largely a subsistence activity. 60% of the population are involved in farming, yet it accounts for less of its GDP, and Kenya's agricultural yield is lower than expected per hectare production.

So Kenya is late in developing but even this very fact offers a large scale opportunity for international investors and big-ticket entrepreneurs. Economic diversification and lasting wealth creation begins with a vibrant agriculture sector. Billions of dollars a year over the next ten years is needed to transform Kenyan agriculture and create the vibrancy. It's a lot of money, but it is available, even within Kenya, if the projects are good enough.

And they ought to be good enough, since such investments will create new markets worth billions per year in added revenue by 2025. That's a potential return of at least 100%. But which producers will own, influence and leverage these markets? Most, surely, should be made in Africa? We must own our development.

And with such transformation would come the reduction of Kenya's net trade deficit in food, potentially bringing net savings of up to billions of dollars per year. We must bring an end to the costly and damaging anomaly of the net deficit in food. No more should Kenya produce what it does not or cannot consume, and no more should it consume what it does not (but could easily) produce.

Other related measures would deliver similarly impressive albeit incalculable financial impacts: fiscal inclusion, tax reform, domestic

revenue mobilization, higher remittances, reduced corruption and better governance.

There are also still huge and unexploited growth opportunities. The country is endowed with uncultivated arable land and huge reserves of water. But how to bring about this transformation? How to close this potential deal of the century? Public and private sector should be acting together. They are needed to provide significant opportunities for Kenya's emerging innovators and entrepreneurs, not to mention its financiers, fund managers and financial advisers.

Over the past few years, the Bank has been able to bring about a comprehensive re-evaluation of the potentially enormous role of agriculture in the transformation of Kenya, and the AGRF has been a critical factor in the shared objective with the Bank of bringing about the green revolution in Africa.

The technologies to feed Kenya exist already. This is the period of climate change. High yielding drought-tolerant maize can allow farmers to grow a good crop even during droughts. Some cassava varieties can yield 80 tonnes per hectare. High yielding rice varieties that meet or beat international standards of imported rice now exist. Orange-fleshed sweet potatoes allow us to address the problem of vitamin A deficiency. Tropical and drought-tolerant wheat varieties are being grown in Nigeria, Kenya and Sudan.

These technologies need to be scaled up for widespread adoption. This will not happen by itself. It will require specific incentives. In particular, the African Development Bank and the World Bank plan to jointly provide \$800 million through "Technologies for African Agricultural Transformation", a flagship programme for the scaling up of agricultural technologies to reach millions of farmers over the next ten years.

For agricultural transformation more generally, the African Development Bank has committed

\$24 billion to agriculture over the next 10 years, with a sharp focus on food self-sufficiency and agro-industrialization.

It's also why African Development Bank launched the Affirmative Finance Action for Women in Africa (AFAWA), to make an extra \$3 billion available for women entrepreneurs, in order to improve food production levels on the basis that women are demonstrably more dependable and bankable than men.

Getting our youth involved in agriculture as a business is crucial. That is why the Bank launched the ENABLE Youth program. This program will provide access to capital and capacity to "Agripreneurs" to create about 300,000 agribusinesses and 1.5 million jobs in 30 countries across Africa, with an estimated investment of \$15 billion over the next five years.

With so many entrepreneurs now on the case of farming, an issue to resolve quickly is the current low level of commercial financing for agriculture. Finance and farming have not been easy partners in Kenya, and the farming sector receives minimal of the overall financing provided by both the government and the banking sector.

I predict that the next few years will see agriculture emerge fully from poverty and subsistence to become the next big booming business sector of Kenya, with entrepreneurs, financiers, inventors and innovators all gathering round a honey pot of bankable projects, programmes and opportunities. After all, who eats copper? And who drinks oil? Africans need to become producers and creators, and not just consumers, in the fast-moving enterprising business of food.

Edited copy of Dr Akinwumi A. Adesina authored ahead of the African Green Revolution Forum. He is the president of the African Development Bank.



African Heroes and the Superpowers of Agriculture

For most people, the notion of a hero conjures up images of brave individuals risking their lives for others, or “superheroes” from comic books or films, armed with supernatural powers. But what Africa needs, each and every day, are heroes of a different sort – “action heroes” with ideas and vision, ready to respond to challenges that could determine the fate of a continent with a land mass larger than the United States, Western Europe, China and India combined. This is a lot of land, with a lot of potential.

Africa’s challenges are well known: A devastating drought is destroying crops in Eastern and Southern Africa. Plummeting oil prices are undermining economic growth in exporting countries, notably Nigeria. Chronic hunger still plagues one third of our people, with deep poverty trapping almost half the families on the continent in dire hardship. There’s an urgent need for employment prospects for the 200 million between the ages of 15 and 24 who make Africa the world’s most youthful continent.

Millions of African farmers still lack access to improved crop varieties that boost yields. They need mineral and organic fertilizers that revive soil. They need access to credit to purchase farm inputs. They need better information about market opportunities to justify their investments. While we can get cell phone signals to Maasai livestock herders, most African farmers still struggle to find a bag of quality seeds or a small amount of fertilizer!

Where are the African action heroes who can tackle these continental challenges? In a new effort to find them, in April 2016, several organizations joined forces in Accra, Ghana to launch the new \$100,000 Africa Food Prize (formerly the Yara Prize). This new Africa-based award will recognize an outstanding individual or institution which is leading efforts to change the reality of farming in Africa –

from a struggle to survive, to a business that thrives! We’re looking for bold initiatives and technical innovations that can be replicated with excellence throughout the continent.

We know there are African action heroes in our midst, doing extraordinary things in the extraordinary world of agriculture, which I believe holds the key to Africa’s future. We want to hear about them and recognize their work.

What do I mean by extraordinary? I mean young people like the Ugandan entrepreneur, Eric Kaduru, who founded an organization to help hundreds of out-of-school girls set up their own commercial fruit farms, or Zimbabwean agricultural expert and animal scientist Dr Lindiwe Majele Sibanda who heads up a policy think tank, working to ensure African agriculture figures prominently on the global agenda. I mean people such as grassroots activists working to help smallholder farmers get access to markets, agri-tech inventors and innovators linking farmers to vital information, and reformers who advocate for better agricultural policies at all levels, from state presidents to village chiefs.

One Trillion Arguments for African Agriculture

Why is agriculture such a critical field of action? To begin with, two-thirds of Africans work in agriculture, the sector responsible for Africa’s food security. On a continent with our rich natural resources and human capital, it makes absolutely no sense for Africans to be importing so much of our food from elsewhere in the world. We should be supplying it to ourselves. This is a massive market and a massive opportunity. The World Bank estimates it will be worth \$1 trillion by 2030!

If I were going into business today, and looking at the market opportunities for African food producers and Africa’s incredible

endowment of natural resources and human capital, I would choose agriculture over telecommunications.

This is the goal and the inspiration for the Africa Food Prize: When our action heroes complete their missions, every African consumer will enjoy better access to affordable, nutritious food -- grown and supplied by African farmers and African food companies. This means new job opportunities and higher incomes for rural Africa. This in turn will fuel wider economic expansion, benefiting everyone, but especially the poor. This is something boom-bust oil economies just can’t deliver.

A Food Prize and the Path to Prosperity

Past winners like Kaduru and Sibanda are the kind of heroes Africa needs today. There are so many others. For example, last year African leaders selected Akinwumi Adesina, a 2007 Yara prize winner, to be president of the African Development Bank. A champion for “impact at scale” across Africa, Adesina served as Nigeria’s Minister of Agriculture and Rural Development where, among many reforms, he introduced pioneering technology to help curb corruption and improve access to inputs for rural farmers, and especially women.

A couple of years ago, a few young entrepreneurs in Nigeria launched a new series of comic books featuring something novel: African superheroes. It’s my hope that one day soon, we will be telling the real-life stories of the “action heroes” of the Africa Food Prize, and how their amazing feats helped conquer the evils of hunger, climate change, poverty and unemployment.

Strive Masiyiwa is the Board Chair, Alliance for a Green Revolution in Africa (AGRA) and Executive Chairman and Founder of Econet Wireless

Seed certification critical

For over 50 years, CIMMYT has led the research and development of quality, improved seed, designed to help farmers mitigate the effects of climate change while improving livelihoods.

Every new variety released is driven by farmer needs and preferences, with desirable traits such as pest and disease resistance, drought and heat tolerance as well as water and nutrient use efficiency. With improved maize seed, farmers not only benefit from increased stress tolerance, they also enjoy higher yields, increased nutritional value and improved income from grain sales.

To ensure that quality seed standards are maintained, CIMMYT supports partners such as national agricultural research institutions and seed producers in acquisition and production of pure early generation seed, which is then tested by national quality assurance and certification agencies before certification and release.

Seed certification process

Seed certification is a rigorous process of testing new maize varieties before they are made available to farmers and follows an often lengthy three-step process.

The first step – value for cultivation and use, or national performance trials in some countries, – compares traits of the new variety to others already in the market to determine its value. For a new variety to enter the market it must have significant value to the farmer, such as higher tolerance to stress, or added nutritional value. It is at the end of this valuation process that a variety is registered, which takes about 2-3 years.

Next, a distinctiveness, uniformity and stability test (DUS) is performed on the seed sample provided to ensure that it is unique, uniform



and will not deteriorate over time after its release. The DUS also helps to determine if an identical variety already exists and is registered, in order to avoid conflict among companies that are responsible for variety commercialization. The characteristics used to compare these materials are developed by breeders, and help distinguish different varieties. The length of time for DUS test varies by country, but on average the minimum is two planting seasons, about two years in most countries, or one year in others.

Finally, the government approves the variety for release and commercialization. In some countries, such as Tanzania, there is an extra classification of seed known as quality declared seed which is certified seed that has been through fewer steps of certification. It is perceived to be of a lower quality than regular certified seeds, and is therefore cheaper.

Seed certification protects farmers from unscrupulous traders who would otherwise sell poor quality seed or grain packaged as seed. Seed certification and commercialization can take 6-11 years, depending on how efficient a country's system is. This lengthy and costly process can sometimes create backlogs, slowing release and commercialization of new varieties. This can discourage some seed companies from producing improved varieties, thus sticking to tried, tested and profitable varieties no matter how old they are. Commercializing a new variety is a huge investment in terms of cost, expertise, promotion and labor, so the longer certification process draws out, the more costs a company incurs. Farmers in turn continue to purchase the varieties that are always available, keeping them in demand.

Expecting seed companies to replace an old variety for an improved one is somewhat complicated, since this is a purely business decision where profits are priority. In some cases, dropping a popular variety to promote a new one could jeopardize a company's market share, brand recognition and potentially put them out of business. This is why old varieties like Matuba in Mozambique, SC513 in Zimbabwe and H614 D in Kenya remain popular, despite being decades old.

Older seed dominating the market causes both farmers and seed companies to miss out on potential benefits and profits higher-performing seed can bring. Several strategies to retire old maize varieties and build demand for improved ones can be used, including demonstrating old and new varieties side by side in areas where target markets exist. This way, farmers themselves drive the process and start the switch to new varieties. Seed producers can emphasize a specific characteristic in the variety that will benefit the farmer. For instance, farmers in an area prone to maize lethal necrosis (MLN) are more likely to adopt a resistant variety, and eventually make a permanent switch once this characteristic is proven to be true.

Government policies can also encourage the retirement of old varieties, for instance through subsidies on seed production with requirements to only include new materials. CIMMYT, through its various projects, gives competitive financial grants only to companies that produce improved maize seed. An extreme and potentially detrimental option would be to cut off funding and other support to seed companies that refuse to phase out old varieties.

Courtesy Cimmyt Newsletter

Practical applications for business growth through developing people

Great leadership qualities undoubtedly include having a clear vision and goals and effective communication to share these ideas with others.

Leadership development in agriculture has been recognised, critiqued and disseminated down to farmers for a number of years, learning from corporate industry and transposing into the Ag-sector, and there is much research and training already on offer within this subject.

This knowledge transfer has been successful within agriculture and looking back 20 years, this teaching may have at first been seen as 'too corporate' for the farming world, but as attitudes have slowly changed to adopt more of a corporate approach and recognise the benefits of these practices, behaviour has changed and in turn increased the productivity and profitability of the farming industry.

Knowledge transfer is recognised as a vital process and practice within any industry but how people then use this knowledge is arguably of more consequence to the development of the sector. 'Investment in human capital' has been shown to provide a 40% higher ROI vs 'investment in knowledge capital' and therefore the recognition of emotional intelligence and investing in soft skills.

What is emotional intelligence? What are the practical tools for increasing emotional intelligence and developing leadership skills within employees in the Ag-sector, in order to increase business growth?

The main tools personality profiling, coaching, neuro-linguistic programming (NPL), developing mindfulness, and meditation. These are practical applications that can be introduced into any business and further

develop the understanding of the mind to allow the progression of the four pillars of emotional intelligence: self-awareness, self-management, social-awareness and social-management.

Research suggest that companies with clear employee development programmes experience faster and more significant growth and most importantly, one size does not fit all and a holistic approach should be taken and, where possible, a personalised programme of development devised for individual employees.

By understanding ourselves and others better, we can be better leaders, better followers and work together more effectively to achieve any shared vision or goal.

A Clean Employee Development Program

Many farmers are 'doers' and 'hands on' and these are things you can practically 'do' to support the development of yourself and those around you in your business. These tools, used in conjunction with your current resources, will greatly support you achieving your vision with a little more clarity and a lot less stress.

Emotional intelligence is not something new that has come into existence, but it is a relatively modern movement to be talking about this concept openly within businesses. If not already doing so, I urge you to consider it.

This topic is about people and they feature in some way, shape or form in every business, therefore there should be something for you to gain – even if it just the reassurance you are doing the right stuff.

Corporate experts in a variety of industries are widely introducing use of emotional intelligence training techniques which drive business growth forward.

Companies that have clear employee development programmes experience fast and significant growth.

One size does not fit all and a holistic approach should be taken within training and where possible a personalised programme of development devised for employees.

Meditation/Mindfulness training improves concentration, memory, organisation skills and develops creativity and awareness skills.

Understanding the working of the mind can improve the understanding of our self, better management of our self and in turn a better understanding of others.

Companies that have a clear employee development programmes experienced fast and significant growth.

Leadership is for everyone not just people in the top tier of the company and therefore leadership training should be disseminated through all levels of the industry.

Introducing mindfulness to the wider agricultural sector could be beneficial for many issues, including; reducing stress, supporting consistent leadership skills, increasing innovation, developing more effective leadership and the overall growth of the Ag-industry.

Neuro Linguistic Programming (Brain-talk training) can greatly increase self-awareness, self-management, social-awareness and social-management.

Training and exercising the mind should be as widely discussed and accepted in society and the workplace as exercising and health for the body is currently promoted.

“Building a Sustainable Farm Business

Food production and the environment must go hand in hand. There are various models for building a sustainable farm business, valuing our environmental, human and social assets. There is need to explore the concept of sustainability, and team up with a range of inspirational eco-entrepreneurial farmers and pioneering academics.

Our ecosystems and natural resources are being continually depleted. Farmers are far from achieving a sustainable level of existence and development. Agriculture and our food chains are, whether we like it or not, a major culprit.

However, our wonderful industry also has many of the answers, and great examples of practical farming and pragmatic programmes that deliver. Therefore to build a sustainable farm business and a future proof industry we must:

‘ **If we measure the wrong things we get the wrong answers and develop the wrong strategies. Too many businesses focus on output (tonnes per ha, litres per cow etc.) at the expense of outcomes (net profit, improved soil, happier workforce etc.) .**

Tell our story and celebrate our industry

While there are numerous problems and glaring disparities, farming is a career and way of life full of heritage, great people and promise. No other industry delivers so much; from food and fuel to fun, flora and fauna. While the industry has borne the brunt of much criticism over the years, and quite rightly so in many cases, we also have many of the answers to society’s ills at our fingertips - there are great opportunities ahead if we work together. Let’s tell our story and celebrate. It is easy to forget, when bogged down in mud, paperwork or routine, how wonderful and colourful farming is sometimes.

Put soil health first

The clearest conclusion is the importance of soil health. Without a fully functioning soil we do not have the foundation for a sustainable farm business. Without good soil management our yields will not meet the needs of the future. While this is recognised, there are still examples of bad practice. Farmers must do more for soil organic matter, and improve our

understanding of bacterial and fungal activity. Minimal tillage, cover crops, composting and better rotations that include grasses and herbs, are all crucial. And improved soils must span all labels – whether organic, biological or conventional – with the use of natural and agro-ecological processes being the norm.

Celebrate the role of small farmers

Small farmers across the globe deliver so much. The smaller farm remains the bedrock of the industry and of fragile rural communities. Their production is not fully captured by traditional GDP measures, and associated economic and social multiplier effects are complex. To avoid a spiralling crisis of participation we need to celebrate and support the role of small farmers and seek more eyes per acre.

Nurture people

It is often easy to overlook the role of human capital in a farm business. Without good people a business is nothing. A sustainable farm business needs people with passion,



energy, skills and knowledge. Farmers need people who are prepared to work hard for just reward and progression. A sustainable industry needs leaders with vision and inspirational communication and management skills. The most impressive businesses are engaging with others at all levels. The best programmes and policies understand stakeholders' motivations and leverage points.

Seek outcomes not output, effectiveness not efficiency

If we measure the wrong things we get the wrong answers and develop the wrong strategies. Too many businesses focus on output (tonnes per ha) at the expense of outcomes (net profit, improved soil, happier workforce etc.). Drives for efficiency and economies of scale, such as larger farmed units with a simplified system, can result in a reduced set of outcomes. A sustainable farm business will seek balanced economic, environmental and social objectives and targets using a more holistic approach. A sustainable food and farming policy will consider the range of public goods and not just focus on food security. A change of mindset is needed here.

Build diversity and complexity

For too long farmers have followed reductionist science and policies of specialisation. There is need of diversity of farm types, entrepreneurs and enterprises within farms. Farmers need a diversity of plants in grassland swards providing different rooting depths and nutrient attributes. Farmers need a cropping and habitat mosaic not based on over-simplified prescriptions. Farmers need biodiversity – from pollinators and earth worms, to rare breed genetics. Farmers need a diversity of people. Diversity and complexity brings increased resilience (to, for example, climate change) and economic, agronomic, environmental and social benefits.

Seek regenerative agricultural systems

Soils, ecosystems, biodiversity and natural resources are being continually depleted. Farmers are far from achieving a sustainable level of existence and development. While farmers can find some success, they are still on a crash course to self-extinction. Top priority is economic growth and basic food security. To help turn the tide, government

must move away from simplistic policies based on sustainability and the status quo. They must be bold and seek and support regenerative systems - practices that put more back than they take out. Regenerative agriculture can rebuild soil, enhance habitats, strengthen rural communities and create new business opportunities. Organic farming approaches are key here but conventional technologies and innovation play a role too.

Move to a true cost paradigm

It can be said that it is more profitable to farm unsustainably than it is to farm sustainably. The drive for cheap food is forcing this race to the bottom. The external costs of our food system are passed on to others or ignored. There is need to develop a new system, a true cost paradigm, that places fair monetary value on the benefits and impacts of different farming and food production systems. We should introduce policies that correct damaging practices and support the development of systems that deliver positive environmental and public-health outcomes.

Industry

Government should work with all farming, food and environmental stakeholders to develop an integrated food and environment strategy with regenerative agriculture and soil at its very heart. Food security goals should not drive this strategy – output should be balanced with the diverse range of economic, environmental and social outcomes. The strategy should seek a new partnership between local consumers and producers, nurture people within the industry and celebrate the smaller farmer.

The industry should work together to develop a new support mechanism for farmers that rewards the provision of valued environmental and social public goods. New models of delivery should be considered and a true cost paradigm introduced. The scheme should be based on results (those providing the most public goods receive more) and be simple, practical and value for money.

Industry should work and support rural entrepreneurs promoting diversity of enterprise, cooperation and good leadership. Particular emphasis should be placed on developing new enterprises that draw on and build (not deplete) natural and social capital, for example, local food initiatives, appropriate renewable energy schemes, agri-tourism/eco-tourism projects and educational activity.

Industry should press for improved food legislation and labelling, backed by an industry campaign, to help consumers choose value and pay the true cost of produce of defined quality. The farm brand should be the farm of origin.



Government

The government should further engage with the wider industry, leading the development of strategies and support mechanisms that reward multi-functional and regenerative agriculture. Whereas the industry should not focus on food security at all costs, it should seek a range of outcomes too.

The government should be bold and innovative, and trial new models of support, communication and advice delivery.

The government should ensure their policies are attractive and open to young farmers and rural entrepreneurs, helping to nurture the next generation and human capital.

The government should recognise and celebrate the role of the smaller farm.

‘ Our ecosystems and natural resources are being continually depleted. Farmers are far from achieving a sustainable level of existence and development .

Soyabeans,

benefits and the simple science behind crop rotation



My grandmother used to tell me that I am not supposed to plant the same crop on the same land consecutively.

And when I asked her why not? Her reply would be it was not right. Well, that is where her understanding ended, but all she was telling me was to rotate crops to fight pests for more yields. Now, let's explore the benefits, rules and the science behind crop rotation.

Why Rotate

The first rule is that crops of the same family should never be planted following each other because they share the same pests and diseases. At the time of growing the first crop, there will be pest and diseases that will build up. Therefore, by the time you plant the second crop of the same family, the diseases and pest will be ready to attack it.

Weeds in most cases are not beneficial to the crop since they act as alternate hosts of both pests and diseases. This is apart from competing with crops for nutrients, space, sunlight and water.

The second rule is that in the sequence, there needs to be a legume. Leguminous crops e.g soya beans. The advantage of having soya beans in the sequence is that it fixes the atmospheric nitrogen into the soil through a process known as biological nitrogen fixation with the help of micro-organisms found in their roots known as

rhizobia. This means the atmospheric nitrogen, which is in its molecular form N_2 is converted to ammonia (NH_3).

The ammonia is then converted into ammonium (NH_4^+) which is the form that is utilised by the plant. After soya beans are harvested, the amino acids in the crop are realised back into the soil where they are converted into nitrate (NO_3^-), which is a form that is utilised by plants. You can rotate a cereal such as wheat with soya beans.

Furthermore, legumes are also called green manure. This is because of their ability to biologically fix nitrogen into the soil. For you to get the maximum out of green manure, you need to incorporate the legume into the soil. Green manure also has the advantage of improving the soil structure and the water-holding capacity of the soil.

The third rule of crop rotation is to rotate crops with different rooting depth. The deep-rooted crop should be rotated with the shallow-rooted. For example, sunflower (deep-rooted) should rotate with wheat (shallow-rooted).

Crop rotation keeps the farmer in production throughout the year. Although the planting seasons are determined by the amount of rainfall, a farmer should take advantage of this using a rotational sequence

Crop rotation further helps to reduce the amount of fertiliser used, especially if you incorporate legumes, thus cutting the cost of production and increasing the profit margins.

Though not proven, there is an increase in yields in a rotation sequence, which some agronomists term as the rotational effect. The growing of the different crops on the same piece of land in the same season also cushions the farmer from losses.

Crop rotation encourages the utilisation of various crop species, it assists in the build-up of soil organic matter, improves soil structure and the chemical and biological soil environment. Soil organic matter has additional advantage of improving water infiltration and retention, increased drought-tolerance and decreased soil erosion.

The main disadvantage of crop rotation is that the types of the crops chosen depends on the farmer's preference, which is influenced by the environment especially water availability and temperatures.

Income generation

Soya can become staple food in Kenya. It's possible for each rural household with a piece of land to plant on at least $\frac{1}{4}$ acre and produce 100 kg of beans needed for annual consumption of five people. The requirements are few: only 5kg of seeds, a $\frac{1}{4}$ acre of land, the family members will



provide manual labour for production and preparation.

Ordinary tools and materials readily available in the will work. The total investment needed to allow a single household to produce the quantity of soya beans to feed them for a year is about KSH 1600 per annum.

Soya bean production is an income generation activity. By investing less than KSH 8,400, a farmer can generate a profit of KSH 84,000 on one acre of land annually. A farmer will need only 25 kg of seeds, one acre of land, some tools and manpower. You can generate more income with soya bean production than maize, cassava or bean production!

At home you can use soya food products in a huge variety of recipes. You can prepare soya foods from home grown soya beans or buy them at a local market. A family of five will need 100 kg soya bean grains annually. A price of one kilo of soya bean grains is less than KSH 84. Two kilos of soya bean grains per week is enough to provide nutrition to a family of five.

With less than KSH 840,000 you can build and operate a small scale unit to produce soy food: soy milk, tofu, soy flour, etc. and generate at least KSH 84,000 every month.

That's pretty incredible!

You can buy and sell soya products in a retail shops. There are also restaurant opportunities being created through this industry. Opening a restaurant in your city – you can invest less than KSH 168,000 and make a monthly profits of KSH 42,000.

Agro-processing

Soybeans are grown for their oil and meal. Soybeans are crushed, the oil is extracted and the by-product is high-protein soybean meal. The oil has many uses including as an edible vegetable oil. The meal is used as a source of protein in animal feed and primarily included in feed for poultry and fish. Less is used for beef, dairy, sheep or goats.

Seeds

So the key is to select varieties that are adapted to your day length, soil type and weather environment (rainy or dry or irrigated). KARLO have done a great job of breeding and selecting adapted and high-yielding varieties. In Kenya you don't have too many choices for seed. Seedco have also developed another variety which is adaptive to Kenya. Having the right variety of good quality seeds will make all the difference on whether your venture is successful or not.



In Summary

- The first rule is that crops of the same family should never be planted following each other because they share the same pests and diseases

- Weeds in most cases are not beneficial to the crop since they act as alternate hosts of both pests and diseases

- The second rule is that in the sequence, there needs to be a legume which include the common bean, lentils, garden peas, soya beans, peanut/groundnuts, chickpeas, pigeon peas, cowpea and green grams and pastures such as alfafa, clover and lupin, among others.

- You can rotate a cereal such as maize with soya bean.

- Crop rotation further helps to reduce the amount of fertiliser used, especially if you incorporate legumes, thus cutting the cost of production and increasing the profit margins.



Network or Notwork?





Networking is often considered to be the realm of politicians or socialites. It may be viewed as an insincere or superficial activity, or perceived as a ‘talkshop’. But to fail to recognise the power of networking is to miss out on an invaluable opportunity for personal and business development. Despite the advances in technology and efficiency, human interaction and communication will remain key to the success of these same technologies, whether it is in their development, promotion and application, or their refinement.

Farmers currently engage with many varied service providers (SPs) as part of the management of their business. These agricultural service providers rarely engage with, or even know each other. Yet, they are all working towards a common goal-to provide a good service to farmers to enable them to run an efficient business. In the 300s B.C. Aristotle said “The whole is greater than the sum of its parts”. What if this were to be applied to the agricultural service provision sector? If it worked as a “whole” could it be more effective than the sum of its parts? To achieve this, there is a need to embrace and support interprofessional working, and public and private sector collaboration.

Benefits of agricultural SPNs:

As farming systems evolve and business decisions change, so too will the demand for an even broader range of skillsets. Service providers will need to either upskill in new areas, or have connections and work with experts from other fields in order to provide a comprehensive service to their farmers. Knowledge exchange between service providers is an essential part of continual professional development. Developing cross-professional networks can facilitate this, as well as improving the feedback loop from extension to research and development.

The current reality in public agricultural extension services is that available resources are contracting. Fragmentation in the service provision industry means that agri-professionals often work in isolation. Both of these challenges can be addressed through the development of cross-professional networks.



SOCAA: One of the Kenya SPs has been very active.

Current activity and case studies:

There are examples elsewhere of service providers working together in structured industry programmes. There are also organisations that through their work are building networks between organisations and agri-professionals from certain sectors. There are several international examples of programmes and organisations that provide an opportunity for individuals from various disciplines to connect.

Barriers to developing cross-professional networks:

While there are clear benefits from building broader networks in agriculture, to both the service provider and the end-user of their services, it would be idealistic and naive not to recognise that there are also barriers to building these networks. Firstly, making time to partake in networking and upskilling events is a constant challenge for service providers. This can also be more difficult in certain employment situations

‘**As farming systems evolve and business decisions change, so too will the demand for an even broader range of skillsets. Service providers will need to either upskill in new areas, or have connections and work with experts from other fields in order to provide a comprehensive service to their farmers’**

e.g. self-employment, or when an employer does not support networking because they do not recognise the value of it. Service providers also rarely have an opportunity to meet people from other disciplines in their local area, and when they do it can often be an intimidating situation, particularly for newer graduates. Competition between service providers, both real

and perceived, can also be an obstacle to building networks, when people feel they cannot work together for fear of losing business or clients.

Requirements to initiate and sustain networks:

Although there are challenges to building networks, the reality is that it can be done effectively. In general, the positive outcomes from networking outweigh the real challenges and the perceived ‘threats’. Networks rarely just start or appear by accident- to build cross-professional networks, it is important to have a driver. This driver, also known as an ‘honest broker’, needs to be respected as an inclusive, neutral body, to act as an intermediary between the various stakeholders, and facilitate their interaction. Nurturing trust, showing relevance, building awareness of the networking opportunities and stakeholder engagement at a management/organisational level are other important building blocks, all of which the ‘broker’ can play a role in.

So What?

Building broader networks and working in teams can be advantageous to both the service provider and the end-user of their services. However, it would be idealistic not to recognise and explore some of the barriers to building these networks and working as a team.

Firstly, **time** is often a limiting factor. Peoples’ working lives are already busy, and in many cases are getting busier with increased bureaucratic burdens, and a reduction of available resources. Trying to find time to attend ‘more’ meetings or training events can be a real challenge, no matter what the potential benefits are.

This is particularly true when there is not an immediately tangible and quantifiable return.

This emphasises the need to communicate the message about the efficiencies of networking. Rather than looking at networking as an additional ‘job’ to be done, SPs need to be encouraged to look at networking as a means of upskilling and improving client services in a cost and time-efficient way. With networks, SPs can quickly and easily tap into complementary skills and expertise when necessary, instead of trying to be all things to all people. Avoiding duplication of existing activities is important if a service provider network is to be valued and successful. Rather than creating another structure for people to join, it is better to consider what is currently in place and see if that can be enhanced to deliver the objective.

Competition between professionals can also be a challenge, particularly when initiating networks. Many professionals have a ‘healthy’

suspicion of other professionals working in the same region, and may worry about losing clients or business. However, this suspicion is often borne out of ignorance of and isolation from other professionals. Once SPs have an opportunity to connect and understand the different roles that they play, and varying skills that they possess, what was a perceived threat becomes a potential opportunity e.g. knowledge exchange, improved service to clients, referrals etc. As Jeremy Philipson of Landbridge (2015) said “How do experts work with other experts? How do we build respect across the professions? It’s not necessarily a problem, but it needs to be understood and managed. This is an opportunity for learning across the professions-we say to people “come out of your own silos and enter an environment that allows you to look at the interface (between professionals)”. Experience has shown that some professions and/or individuals are more secure than others about interprofessional working and are happy to signpost to other professionals. Most of the professionals are very willing to bring in outside expertise when necessary. Some others prefer to manage the inter-professional working out of the view of the client.

While it may be accepted that working as a team and networking with other disciplines has clear benefits, in the author’s experience agricultural professionals rarely have an **opportunity to meet** professionals from other disciplines. In Kenya, as in many other countries, there is no structured mechanism for service providers across all agricultural sectors to get to know each other. Inter-disciplinary professional development is uncommon, as most service providers attend profession-specific training. Unless connections with service providers from other sectors are facilitated in some way, it is not uncommon for several agri-professionals to work in one region yet have no knowledge of each other. Developing professional relationships is a lot easier when there are pre-existing personal relationships.

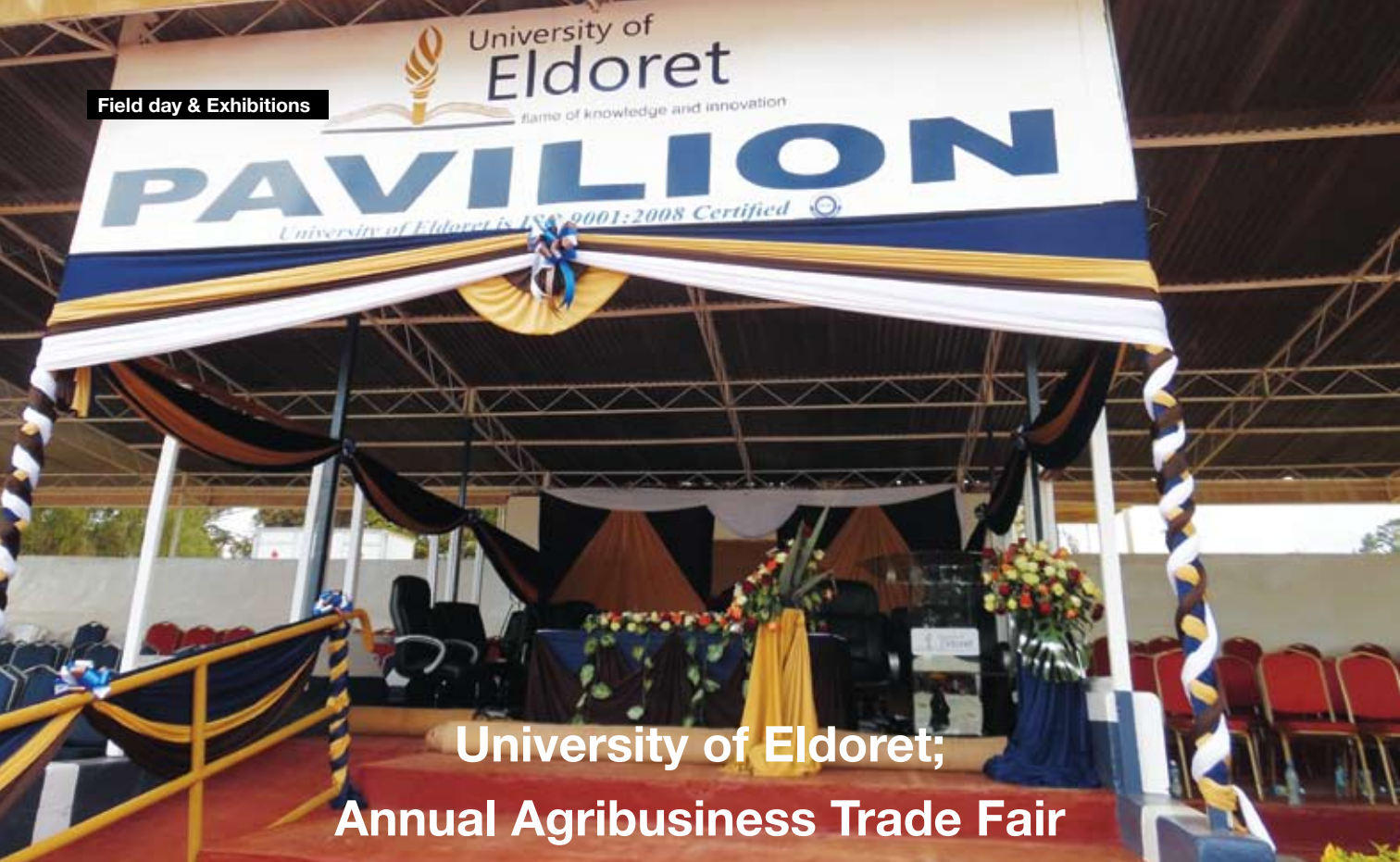
Feeling intimidated, or fear of the unknown can also be an obstacle-sometimes introducing oneself can be scary! For example, while experienced agri-professionals are an invaluable source of knowledge and

information for newer graduates, and are often very important mentors, without facilitating these connections young agri-professionals can often feel intimidated by this wealth of experience and knowledge. All too often we hear someone say after a conference “I really wanted to ask her something about grassland management, but I don’t really know her and didn’t want to look stupid”? It is not only young graduates that can encounter this ‘imposter syndrome’. Joe Horner (2015), from University of Missouri commented that “when a farmer suggests “my agronomist, nutritionist and bank manager are going to meet next week and I want you to come along too” it’s refreshing and intimidating. There is the fear of losing face, or realising that you’re not an expert on everything!”. The opportunity to exchange knowledge and work together is greatly enhanced if these personal connections have already been initiated.

Employment situation can also be an impediment to interprofessional working. Agri-professionals work in various situations in Kenya; some are self-employed while others are employed in a salary position, some work in the public sector and others work in the private sector. For some, investing time in a knowledge exchange network will be seen as an important part of their role profile; while for others it may simply be seen as time spent away from income-generating or ‘real’ work. Communicating and promoting the value of networking at an organisational level, will be an important step for the industry. There is no point in trying to encourage individual agri-professionals to network and make interprofessional connections, if their parent body or employer doesn’t also embrace and support the concept. Managing the expectations of both the participants in a network and their employers is also important. The reality is that returns on this investment may not be tangible, or immediately apparent. However, it has the potential to add value to the services currently offered by a company or individual, improve the direction and development of research and enable service providers to upskill and work more efficiently.



‘Managing the expectations of both the participants in a network and their employers is also important. The reality is that returns on this investment may not be tangible, or immediately apparent. However, it has the potential to add value to the services currently offered by a company or individual, improve the direction and development of research and enable service providers to upskill and work more efficiently.’



University of Eldoret; Annual Agribusiness Trade Fair

Enhancing Technology and Trade in Agriculture for National Growth

For the sixth year in a row, University of Eldoret has hosted the agribusiness trade fair show. The institution is located 9 kilometres from Eldoret town along Ziwa road off Eldoret- iten highway. Having a rich background in agriculture, University of Eldoret in the year 1946 was used by colonists to train large scale farmers. The institution still emphasizes on this objective of empowering farmers and having outreach programs from time to time. Agricultural and biotechnological courses take the largest percentage of the courses offered in the institution; this has enabled the university to be a research hub when it comes to agriculture, latest innovations and modern ways of practicing agriculture. Due to this capacity, the university launched the agribusiness trade fair show to share knowledge they had in their research and to involve other stakeholders in the industry to ensure the success of the activity.

The 6th agribusiness trade fair show which was held from 21st to 23rd of September 2017, was an exciting event which not only attracted small, medium and commercial farmers but also the entire society at large.

Apart from farmers; suppliers of agrochemical products, inputs and equipments, researchers, academicians, students, regional, state and county government ministry were also present. NGO's, agro-processors, marketers, exporters, importers and distributors never missed this resourceful event. The show which was officially opened by Prof Amb Mbula the chancellor of the university paved way for exhibitors, farmers, researchers and students to transact.

This show came at a time farmers and other stakeholders in the agricultural sector were facing numerous adversities. North rift was heavily affected by adverse climatic changes between January and April when there was shortage of rain; due to this stalemate the region was heavily invaded by army worms which really destroyed and affected the crops. When it hurts, don't press it but seek for a remedy, this is why farmers and researchers grazed the event in large numbers to find remedies for the challenges they were facing in the farm. The event which was held at the university's pavilion square was heavily packed with stands from famous companies and

emerging companies from agricultural industry.

From farm to the folks

The embassy of the kingdom of the Netherlands participated in the event as a major sponsor; their theme "farm to folk" intrigued many. The Kingdom of the Netherlands has demonstrated immense cooperation with the Kenyan horticultural industry especially cut flowers and vegetables. Due to their stability and good integration between companies, business, knowledge institutions and governments they have been able to extend their expertise to potato value chain and improved production of technology, storage and processing of the produce. Change is inevitable and it is why farmers were called upon to drop old ways of farming, to embrace technology and other emerging trends in the industry to realize good yields and food security in the country. "A hungry nation is an angry nation", these sentiments were mentioned by Prof Mbula and literally no one is ever happy when hungry and a hungry person cannot deliver. Therefore she called upon farmers to visit each and every stand to learn new agrochemicals in the market

that can solve the challenges they are facing in the farm and to also learn about exciting technologies that can be used to do modern farming in a commercial way to feed the nation.

Therefore, from farm to the folk initiative came with the all package, right from demonstrations from the farm how potatoes are to be planted, harvesting was also demonstrated by the use of potato harvester- modern way of harvesting potatoes; The Netherlands also demonstrated by the use of highly trained chefs both from Kenya and Dutch on how to cook these produce in an appetizing way. The only way to always measure the value of information and knowledge is when it is shared and communicated to the right person and at the right time.

Farms with highly knowledgeable researchers, with the latest technologies, companies with the latest research in crop diseases and crop protection came together to disseminate this knowledge and information to the farmers to ensure farming is done well in a commercial way so as to enhance economic growth and food security.

The Future

Farmers face numerous challenges, right from climatic conditions, lack of farm inputs, the cost of inputs and the polluted market not to mention unfair trade policies to those exporting their produce. The hopes of the farmers were really raised when cabinet secretary for finance Dr. Rotich passed the message that the government is working on fair trade policies so that farmers and growers earn well from their produce generated from sheer hard work.” The government will transform the agricultural sector and make policies that will absorb farmers’ produce with good prices”, cabinet secretary agriculture Hon Bett promised the farmers that they should not worry because the government have plans for them. Framers were also encouraged by Bett to adopt insurance policies for their livestock and crops so that incase of adversities they won’t be adversely affected. The future of agriculture is invested in the technological innovations, research and good government policies. These factors were discussed well especially the demonstrations



of technological innovations already used in agriculture and latest varieties of the seeds from different companies at the farm, how they are planted taken care of and chemicals to be used so as to realize good yields.

The event created a platform for farmers to learn from experts, take notes, compare notes and purchased latest seeds and chemicals for their farms. This little transformation of farmers and farms one bit at a time will lead us into the future, when agriculture will be done in the right form by each and every farmer without finance being a limiting factor; When participation from banking sector in transforming agriculture is strengthen. Youth forms the largest part of the population; their participation in the agriculture industry will not only increase produce and improve food security but generate income and create employment country wide. Both Dr Rotich and Prof Mbula encouraged the youth to get their hands dirty and venture into agriculture.”The job market is crowded, shift your focus to the food value chain and fit in”, Prof Mbula said. Academic Institutions should develop programs to train youth on agribusiness and entrepreneurship so as to solve the challenges of unemployment.

Getting better

The smile from every farmer’s face as they walked out of the institution was evident that their hearts were at peace. This showed

that they got a solution for their problems and they were yearning to put that into practice in their farms. Looking back, it is not pleasant but things are getting better. Relating to the farmers situation despite the challenges they face and the pains. There are still people who think through farmers problems and these are the organizers of this wonderful event and sponsors. They invested a lot and the institution that hosted the event because they have not only tried solve the challenges farmers’ society face but they have generated networks helpful to the farmers from this generation and beyond. This trade fair was a reminder that we are getting better and propelling ourselves out of the storms. Technology was well enhanced and trade emphasized when these two will be well integrated by farmers, there will be food security, reduction of unemployment and economical growth ad transformation of the entire nation. Information is power, whether you are in the agricultural field already or planning to join, seek information first that will be where to begin investing. Once you get the right information then you will have the right tools to kick start your investment as a farmer. Farmers, exhibitors, organizers and sponsors wished themselves farewell as they promised to attend the 7th agribusiness trade fair show next year. As an investor, exhibitor, sponsor and a farmer plan to attend the show next year and be part of the transformation.

Field Days' Pictorial



Baraka Fertilizer Stand at the Eldoret University Fair



Elgon Kenya Ltd Stand at the Kisima CGA Field day



Agrichem Africa Ltd team at the Eldoret University Fair



A display of Mountain Oil products at CGA Kisima Field Day



A demonstration of Solar Pump at the University Fair



Syngenta demonstration Plot at the Eldoret University Fair



Farmers Flock Amiran Stand at the CGA Kisima Field day.



Farmers visit BASF Stand at the CGA Kisima field day

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