NATIONAL SCIENCE AND TECHNOLOGY FORUM (NSTF)

PULSES AND FOOD SECURITY DISCUSSION FORUM

2–3 JUNE 2016

EMPERORS PALACE CONFERENCE CENTRE, KEMPTON PARK, GAUTENG

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DAY 1

WELCOME AND PURPOSE OF THE MEETING (MS JANSIE NIEHAUS, EXECUTIVE DIRECTOR, NSTF)

Ms Niehaus welcomed the attendees to the discussion forum and expressed a special word of welcome to Ambassador Escanero, Ambassador of Mexico and to the Trade Commissioner of the High Commission of Canada, Ms Sandra McCardell.

The discussion forum was sponsored by the Department of Science and Technology (DST). The coordinating committee consisted of representatives of the DST, Department of Agriculture, Forestry and Fisheries (DAFF) and AGT Foods Africa (AGT).

According to the Food and Agriculture Organisation of the UN (FAO), the International Year of Pulses (IYP) 2016 aims to heighten public awareness of the nutritional benefits of pulses, pulses as part of sustainable food production, and food security and nutrition. The IYP will create a unique opportunity to encourage connections throughout the food chain that would better utilise pulse-based proteins, further global production of pulses, better utilise crop rotations and address the challenges in the trade of pulses.

The NSTF fully supports the aims of UNESCO, and the aims of UNESCO's theme 'Science for a Sustainable Future'. The current event was sponsored by the DST in celebration of the IYP 2016 and was one of many throughout the world to mark the international year of pulses as declared by the United Nations (UN). Ms Niehaus extended her thanks to the DST for their support.

NSTF events are always collaborative, with different parties attending the various forums. The aim is to get government, researchers and industry (the triple helix) involved; however, it is vital for the community and other role players to be involved.

The objectives of the event were to:

- Raise awareness of the benefits of producing and eating pulses
- Engage with government departments about food security issues and policies, as well as the promotion of pulses
- Showcase research related to pulses in South Africa, and promote further research
- Showcase technologies related to the cultivation, processing and production of pulses and products using pulses
- Identify key issues relating to the use and production of pulses and food security
- Identify ways to promote the cultivation, processing and consumption of pulses, and grow the associated industries
- Identify ways to raise awareness and educate the public, including the youth.

The anticipated outcomes of the event were:

- To report on recommendations to DAFF, the DST, Department of Social Development (DSD) and Department of Basic Education (DBE).
- To ensure that pulses are included in the government's policies regarding food security
- To formulate an outline for a ten-year plan to increase research investment so as to close yield gaps for pulse crops in South Africa, as a contribution towards the envisaged global IYP2016 plan to deliver a ten-year plan for US$100 million in increased public and research investment to sustainably close yield gaps for pulse crops around the world.
- To submit a list of pulse-related research projects, both public and private, that are currently conducted in South Africa
- To submit to the National Research Foundation (NRF) a list of research themes and topics that should be further researched
- To produce the outcomes of the workshop in the form of videos and proceedings that would form the basis of a media release highlighting key issues
- To submit the recommendations to government and other decision-makers

The programme included breakaway sessions during the afternoon of Day 1 and panel discussions. Day 2 would address points raised during the breakaway sessions and identify concrete actions to be taken forward.

ISSUES ON FOOD SECURITY IN SOUTH AFRICA AND FAO'S ROLE IN THE ERADICATION OF FOOD INSECURITY AND MALNUTRITION (Dr Tobias Takavarasha, FAO Regional Representative, South Africa)

Dr Takavarasha reported that the 68th UN General Assembly formally declared 2016 as the International Year of Pulses (IYP).The FAO has been nominated to facilitate the implementation of the Year in collaboration with Governments, relevant organisations, non-governmental organisations and all other relevant stakeholders. The IYP 2016 aims to heighten public awareness of the nutritional benefits of pulses as part of sustainable food production aimed towards food security and nutrition. The Year will create a unique opportunity to encourage connections throughout the food chain so as to better utilise pulse-based proteins, further the global production of pulses, better utilise crop rotations and address the challenges in the trade of pulses.

The FAO's strategic objectives are to help eliminate hunger and malnutrition; make agriculture, forestry and Fisheries more productive and sustainable; reduce rural poverty; enable inclusive and efficient agricultural and food systems; and increase the resilience of livelihoods to disasters such as drought and floods.

Food security as defined at the World Food Summit in 1996 is when all people have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. This definition reinforces the multidimensional nature of food security and includes accessibility, availability, utilisation and stability.

It is currently estimated that 795 million people globally are undernourished. The world population is expected to reach 9.1 billion by 2050, and it is expected that 70% will live in cities or urban areas by 2050.Food production will therefore need to increase by 70% to meet consumer demand.

South Africa is one of the developing countries monitored by the FAO that has achieved the Millennium Development Goal target of halving the prevalence of undernourishment by 2015.The SADC region has been experiencing the worst drought in decades, which has led to widespread livestock deaths and harvest failures. There is a paradigm shift towards agriculture and food systems that are resilient, productive and more sustainable for the country to continue striving towards achieving food security for all.

The FAO is working with various partners and centres of excellence to mobilise the commitment to eradicate the hunger problem by 2030.The organisation together with its partners has identified five strategic objectives to sharpen its focus on fighting hunger and to create more sustainable food systems. These objectives are:

- To help eliminate hunger and malnutrition
- To make agriculture, forestry and Fisheries more productive and sustainable
- To reduce rural poverty
- To enable inclusive and efficient agricultural and food systems
- To increase the resilience of livelihoods to disasters.

The FAO's regional initiative is to reduce hunger by 2025. The Comprehensive Africa Agriculture Development Programme (CAADP) has four pillars for fighting hunger and creating a more sustainable food system worldwide:

- Pillar 1: Extending the area under sustainable land management and reliable water control systems
- Pillar 2: Improving rural infrastructure and trade-related capacities for market access
- Pillar 3: Increasing food supply, reducing hunger, and improving responses to food emergency crises

- Pillar 4: Improving agricultural research, technology dissemination and adoption.

The FAO aims to heighten the awareness of pulses as part of sustainable food production. Pulses are an inexpensive source of protein and are a crucial component of a healthy diet, especially in poorer areas where meat, dairy and fish are economically inaccessible. Pulses, if properly stored, remain edible for several years, making them a smart option for households without refrigeration.

There are many drought-resistant pulses, such as pigeon peas, bambara groundnuts and lentils. These pulses can be cultivated in arid climates that have limited and often erratic rainfall of 300–450 mm/year.

Diet is an important contributor to health, and to combating diseases such as type II diabetes, cardiovascular disease and certain types of cancer. Pulses are a nutrient-rich food that can help fight malnutrition in both developed and developing countries. Their nutritional value is double that found in wheat and three times that found in rice, and they are they are high in complex carbohydrates and fibre. The protein of pulses is high in lysine and low in sulphur-containing amino acids, whereas the protein found is grains is low in lysine but high in sulphur-containing amino acids. Combining them provides a higher protein quality, which means that the body needs less protein to fulfil its protein needs.

Pulses also improve animal and soil health and support biodiversity. Crop residues from pulses can be used as animal fodder to increase nitrogen concentration in the diet, which improves animal health and growth. The nitrogen-fixing properties of pulses can improve soil fertility, which extends the productivity of farmland and eliminates dependency on synthetic fertilisers, leading to a smaller carbon footprint and indirectly reducing greenhouse gas emissions.

Pulses also promote below-the-surface biodiversity, as they create a rich home for germs, insects and bacteria of various kinds. Because pulses as a group are genetically diverse, they also hold great potential for climate adaptation, as they enable farmers to select new varieties to adjust their production to changing climate conditions. In using pulses as cover crops and in intercropping systems, soil erosion is reduced, and pests and diseases are more easily controlled.

The FAO is well positioned to support countries in achieving the Sustainable Development Goals to realise a world without hunger; however, this can only be achieved with strong partnerships with other stakeholders.

The DST is assisting the FAO to report on how the IYP2016 in South Africa was celebrated and what activities are planned to promote public awareness of the nutritional benefits of pulses as part of sustainable food production and food security in South Africa.

Ms Niehaus thanked Dr Takavarasha for setting the scene and noted in particular Pillar 4 of the FAO's role, which includes disseminating and encouraging research and technology in respect of food security.

NATIONAL POLICY ON FOOD AND NUTRITION SECURITY FOR THE REPUBLIC OF SOUTH AFRICA (Mr Sibongiseni Ndimande, Department of Agriculture, Forestry and Fisheries)

Mr Ndimande shared an oxymoron (or contradiction) with the forum. Prior to the approval of the National Policy on Food and Nutrition Security (NPFNS) by Cabinet in 2013, there had been argument on whether food was a commodity or a basic human right. It was subsequently resolved that food remains a commodity; however, accessibility to food is a basic human right. Cabinet approved the NPFNS together with Fetsa Tlala (Government programme meaning 'eradicate hunger') and the Household Food and Nutrition Strategy in September 2013. Currently in South Africa, the macro agricultural economy is suppressing the micro agricultural economy and cannot provide its own food supplies.

The total maize crop for 2015 was 9 955 million tons, which was 30% less than the 2014 maize crop of 14 250 million tons. A maize crop of 7438 million tons has been projected for 2016, which is 25% less than the 2015 maize crop. This is the lowest South Africa has produced since 2007 (7 125 million tons). Due to the drought and the weakened Rand, it is predicted that a 10 kg bag of maize meal will cost R120

in 2016 in urban areas, and this will result in an even higher price in rural areas as transport costs to these areas are expected to increase. Maize meal reflected 38% inflation in March 2016. The price of chicken rose by 56.13% and this is attributed to the fact that maize is a key raw material for the chicken industry. This presents a worrisome picture for the country. If the Rand weakens further, this situation will be exacerbated.

Problem statement

Overall, South African soil is not favourable for agriculture. Land with the highest agricultural potential equates to 12% of the area of the country and suitable arable land equates to 22%, while the remaining 66% comprises marginal land. Some 26% of agricultural land in Mpumalanga that was used predominantly to produce grains has been lost to mining. This has highlighted the need to mandate that agricultural lands cannot be used for any industry other than agriculture. Furthermore, there is a need for the advancement of research on crop varieties. A further need is the relocation of grain production in Mpumalanga to other parts of South Africa. This will assist in the country in reducing dependency on imports, which are expensive and negatively impact the poor in particular. Plans are currently underway to relocate grain production to the Eastern Cape, as this province possesses a large amount of prime agricultural land that formerly belonged to homelands and has not been optimally utilised.

It is estimated that the poor spend over 66% of their income on food. According to the Statistics South Africa (Living Conditions Survey 2013), 40% of households in South Africa earned less than R649 per person per month, and 20% earned less than R325 per person per month. Due to the devastating drought of 2015 and the weakening South African Rand, food prices increased by 9.8% in March 2016, which has had a devastating effect on the lower-income group.

Under-nutrition is prevalent in children in South Africa between the ages of one and three years; 26.5%of children in this age group are impaired due to stunting in growth as a result of malnutrition. This is found particularly in rural areas and urban informal settlements. This means that the country has lost the economic potential of 26.5% of its future labour force. Universities that are being built for the future generations will be negatively impacted, as the ability of children to take advantage of these opportunities will be impaired. This highlights the fact that nutrition is a key issue in relation to the growth of the economy. ‘Wasting’ (from poor nutrition rather than insufficient food) affects 4.5% of South African children.

A recent survey of countries including Uganda, Ghana and Nigeria, which are in a similar situation to South Africa, showed that South Africa is not moving forward as it should to combat hunger and starvation in children. This is despite the Constitution stating that every South African shall have adequate access to food. Government as the protector and custodian of these rights needs to take responsibility in reversing this situation.

The majority of the population in the former homelands are buying their food as opposed to growing it. The income of households is not increasing, and the economy at large is growing at less than 0.5% per annum. The hunger issues in the country need to be urgently addressed at government level with the involvement of multi-stakeholders. South Africa is importing significantly more agricultural products than it did five years ago. Currently the country is importing sufficient wheat to satisfy domestic demand, but according to projections the demand will grow by almost 90% by 2020. The severe drought has had a devastating impact on food supply, and an estimated 14.1 million people still have food access challenges and go hungry.

Countrywide, the 2015/16 production distribution targets of beans, soya beans and jugo beans is 1741 hectares, 600 ha and 98 ha respectively. These figures are substantively down from the previous period due to the drought. The hectare distribution for the various commodities has had to be divided in order to provide crops for all staple commodities.

The biggest challenge is that South Africans are showing decreasing interest in agriculture, which is a major cause for concern. Only 1.9% of households practice agriculture as their main source of income, while the majority of households (77.5%) practise agriculture as an extra source of food. Investing in

people and educating them in farming skills is thus a key issue. Limpopo currently has the highest number of individuals involved in agriculture, but there is constant migration to urban areas by the younger generation. This problem needs to be addressed by educating the youth in agriculture.

National Food and Nutrition Security Policy

The policy is aligned to Vision 2030 of the National Development Plan (NDP) and has been implemented to ensure the availability, accessibility and affordability of safe and nutritional food at national and household levels. The policy seeks to provide an overarching guiding framework to maximise synergy between the different strategies and programmes of government and civil society. It is hoped that the policy will create a platform to understand the parameters and boundaries of the country's international obligations. South Africa is committed to working together with the other SADC member countries to achieve regional food security. SADC subscribes to the view that policies and programmes must address national, household and individual food security. A regional policy framework is currently being developed in a consultative manner, which is important due to the high climatic correlation among states in the region. Furthermore, economic, social and political changes in the region necessitate closer collaboration between the public and private sectors to achieve these goals. All South Africans are challenged to participate in strategies to ensure the availability, accessibility and utilisation of adequate, safe and nutritious food for all members of households at all times on a sustainable basis.

The goal of the policy will be attained through the implementation of five pillars, which allow for the multi-sectoral integration of initiatives and programmes:

- **Improved nutritional safety nets**, including government-run and -supported nutrition and feeding programmes, emergency food relief, as well as private sector, CBO and NGO interventions.
- I**mproved nutrition education**, providing consumer literacy and assisting with better food management and improved meal planning. This includes monitoring nutritional indices on food labels.
- **Investment in agriculture** to promote public investment in agriculture and to ensure access to support services (cheap credit, inputs, research and technology, and markets) by poor farmers, particularly in rural areas. This includes the provision or subsidisation of inputs and support services for increased food production, as well as more effective food storage and distribution networks to eliminate waste and ensure better access to food for all.
- **Improved market participation** of the emerging agricultural sector through public–private partnerships, including off-take and other agreements, a government food purchase programme that supports smallholder farmers, as well as through the implementation of the AgriBEE Charter, which requires agro-processing industries to broaden their supply bases to include the emerging agricultural sector. Government currently has an annual budget of R21 billion to procure food, most of which is allocated to rural areas. Due to the dominance of major retailers, the development of the rural economy is hampered. This needs to be addressed through the promotion of rural agrarian transformation and greater investment in small farmers so as to curb migration from rural to urban areas.
- **Food and nutrition security risk management**, including the prioritisation of increased investment in research and technology to respond to the production challenges currently facing the country, such as climate change and bio-energy. Biotechnology ownership is vital for the production of food and seeds. Cabinet wants to see new varieties and open-pollinated varieties (OPVs). Rural farmers must be educated to keep their OPV seed for year-on-year production, which in most instances can be recycled for three seasons without significant yield losses. The initiatives must include the protection of prime agricultural land through alienation for other activities such as mining, game farming and property development. Controls need to be implemented to control diseases and pests within the country and cross-boundary. Investments need to be made in marketing infrastructure and food reserve facilities. Agricultural R&D needs to be addressed including the development of drought-tolerant varieties and breeds, climate change mitigation and bio-fortification.

  The architecture of the policy is based on social and economic programmes each with their various platforms. These platforms are headed by the National, Provincial and District Food & Nutrition Security Coordinating Committees together with the Food & Nutrition Security Advisory Councils at both national and provincial level. Information management systems would also be required, with timely and relevant food and nutrition security information to guide interventions. This would include

the involvement of entities such as the South African Vulnerability Assessment Committee (SAVAC), the Multidimensional Poverty Index (MPI), the South African Census, and the Centre of Excellence in Food Security for South Africa (jointly hosted by the University of Pretoria and the University of the Western Cape), SARS and SABS. This will allow new role players to access the agricultural industry which in turn would relate to cheaper food prices as competition will be greater. Mr Ndimande requested that all organisations with an interest in food security become involved in the above platforms as government's agenda needs to be challenged and made aware of new ideas with regards to food security. Ultimately the need for people having adequate access to food must be addressed.

A food security base plan is to be introduced for the whole country. To date, quality data have been collected in Limpopo, KwaZulu-Natal and the Free State. Six other provinces still need to be tackled, but there is a lack of adequate resources. SADC and a number of other stakeholders are supporting South Africa in this task. Without a food security base plan, the country's food supply will be inadequate. The plan will highlight the challenges that need to be overcome.

Rural communities have been divided into very poor, poor, middle and better-off categories, and various issues such as land ownership, livestock ownership, involvement in agriculture, income, food sources have been investigated. One of the findings was that the very poor and poor groups are not involved in agriculture and sell their labour in order to survive, whereas the middle and better-off groups are involved in agriculture because they have the resources to do so. In a typical Limpopo village, the middle and better-off groups own between one and three, and two and five hectares of land respectively. Strategies need to be developed and appropriate design interventions devised to assist the very poor and poor to become economically stable.

The Committee tasked with the implementation of the National Policy on Food and Nutrition Security is led by the National Food and Nutrition Security Advisory Council together with DAFF, DSD, DoH, DPME and other key players. The committee will be chaired by the Deputy President. The policy comprises seven anchor plans:

1. To establish a multi-sectoral food and nutrition security(FNS) council to oversee the alignment of policies, legislation and programmes; to coordinate and implement programmes and services that address FNS; and draft new policies and legislation where appropriate
2. To establish inclusive local food value chains to support access to nutritious affordable food
3. To expand targeted social protection measures and sustainable livelihood programmes
4. To upscale high-impact nutrition interventions targeting women, infants and children
5. To implement policies, regulations and programmes to prevent and control lifestyle-related illnesses
6. To establish an integrated risk management system for monitoring FNS-related risks
7. To develop a monitoring and evaluation system for FNS in South Africa.

Conclusion

Food access remains a problem for 14.1 million South Africans. Social grants provide a cushion against extreme hunger, but for those who live on social grant incomes alone, the adjustment has not kept up with food inflation. Adequate support to smallholder farmers is vital; production support, off-take agreements and distribution logistics should be in place. School education on food security must be implemented. It is hoped that a vibrant and self-sustainable rural economy will be created by producing and delivering food within close proximity. Furthermore, it is hoped that the market share will shrink from the current dominance of four or five parties, which in turn will enable competition and reduce commodity prices. The approval of government's Food Purchase Programme together with inputs through National Treasury will ensure the success of this initiative.

Ms Niehaus thanked Dr Ndimande for his presentation and for his contribution to addressing food insecurity in South Africa. She expressed the hope that the country would overcome the challenge of under-nutrition and the contradictions in the current system.

THE ROLE OF INGIDENOUS KNOWLEDGE-BASED TECHNOLOGY (IKS) IN ENHANCING INNOVATION IN FOOD SECURITY (Ms Mammone Tang, Deputy-Director: Indigenous Knowledge-Based Technology, Department of Science & Technology)

Bio-economy refers to bio-based science and innovation activities and processes that translate into economic activities. The DST continues to manage the national system of innovation according to industry sectors and to incorporate the value chain approach. There are three thematic chapters, namely agriculture, health, and industry and environment.

Local communities possess a wealth of indigenous knowledge developed over centuries for sustainable livelihood. They know indigenous vegetables such as cleome and cowpeas, which are excellent sources of nutrition and which form part of the forum's discussions.

The DST engages with community groups to document their experience in food security. IKS information materials are then produced and shared with those communities. Ms Tang shared how the DST applies for IKS funding. A value chain is identified and a proposal is submitted. An agreement would have been made with the community to gather their indigenous knowledge and community experiences. Communities are encouraged to visit laboratories where research is undertaken on products, packaging and distribution and thus they are educated on the processes. This also gives them the opportunity to share ideas on product, packaging and knowledge transfer with the aim of becoming viable commercial traders. Knowledge is transferred to communities on product development, processes and technologies.

The DST is part of a nutraceutical consortium that comprises the CSIR, ARC and University of Venda. These entities address product development, the development of cultivation methods, and packaging. Communities attend training sessions at the CSIR on topics such as food research and soil sampling, and they attend food-processing workshops where milling operations are demonstrated and where they learn to operate processing plant machinery. An example of this is the Khanyisa Vegetable Processing Cooperative.

At a recent exercise undertaken at the University of Fort Hare, a facility was established to develop the products grown by the community. The products obtained from the crops included herbal teas, savoury muffin mix, and canned leafy vegetables, the latter having already been distributed into rural areas. In the past the focus was mainly on rooibos tea, but the Northern Cape, Western Cape and Eastern Cape also have their own teas, including honey bush. Information was collected from communities, and it was found that honey bush tea is highly nutritious. It is estimated that approximately eight tons per hectare of this tea will generate an income of approximately R12.8million.

The launch of the new 'Maggi Two Minute Noodles with real Morogo' was the result of public–private collaboration between Nestlé South Africa, the CSIR, ARC, University of Fort Hare and DST. This product is already available in supermarkets and is a good example of what can be achieved if private and public companies work together to address issues such as unemployment and poverty.

A further example is the moringa project in Limpopo. Limpopo is a very poor area with a high rate of malnutrition. The moringa tree has various uses and is known for its medicinal properties and nutritional value. Products include tea, energy powder and capsules. Through funding from the DST, the project now boasts an agro-processing plant situated on 25 hectares of agricultural land, which employs approximately 60 people. The original plastic packaging was replaced with high-quality packaging that was designed in collaboration with the SABS. These products have now been introduced into retail outlets such as Dischem and Clicks. Prices have therefore increased, which has resulted in a higher gross profit at production level.

In summary, there is a dire need for human capital development, the development of community-based SMMEs and the forging of strategic partnerships to ensure that communities are protected, self-sufficient and well nourished.

Ms Niehaus thanked Ms Tang for her presentation and the DST for making a difference in terms of finding the indigenous knowledge that needs to be commercialised and which will ultimately uplift the poor.

RESEARCH RELATED TO FOOD SECURITY AND CROP SCIENCES AND DROUGHT RESISTANT VARIETIES (Dr van Vuuren, Manager, Crop Science Research Institute, Agriculture Research Council)

Challenges in facing food production

Agricultural science has to date kept pace with the increased demand for food. Current forecasts anticipate that this trend will continue and that new R&D technologies will become more important to feed the expected world population of 9.1 billion by the year 2050. Africa's population is anticipated to double from its current one billion. This will mean that of the 925 million under-nourished people world-wide, 239 million will reside in sub-Saharan Africa.

The global food challenge is not only about producing adequate food to answer the anticipated demand, but also producing food with a high nutritional value, at affordable prices, by competitive value chains, to ensure sustainability. The vibe word currently heard through the media is 'nutritional sensitive agriculture'. This, however, needs to be produced in the areas where it is consumed, especially in sub-Saharan Africa, which is becoming less food secure.

Challenges in agricultural productivity

Agricultural productivity in sub-Saharan Africa is constrained by inadequate investment in R&D, amongst other things. It has been shown that investment in R&D is likely to be higher in developed economies and that labour, land and capital are also likely to be more productive in developed economies due to improved technologies. To meet the demand for food and nutrition security in sub-Saharan Africa, now and in the future, there is a need to increase the productivity in agriculture. This implies changes in economies of scale, new technologies and human capital.

Dr van Vuuren reported that for the world to have sufficient food by 2050, the total factor productivity (TFP) growth rate should be 1.75%. Globally this figure is reported at 1.72% versus the current TFP growth in low-income countries of 1.5%. This relates to the countries that need to transform with technology.

Food production scenarios

Prices of all agricultural products are expected to change over the next ten years, as there will be growth in productivity and lower inputs will surpass demand. Major changes in demand are expected in developing countries, where slower population growth, rising per capita income and increased urbanisation will increase the demand for food, while modest growth in production is expected in Africa.

Consumption and production trends

Cereals remain the most consumed agricultural product across most cultures. Cereals are the single most important source of dietary energy and remain the most consumed agricultural product, with an expected global consumption of over 2 billion tons by 2017/18. The strong demand for protein meal is driving further expansion of oilseed production, especially soybeans.

South Africa produces between 75 000 and 80 000 tons of the 140 000 tons of dry beans consumed annually. The industry is struggling to become competitive as a result of cheap imports.

Between 1980 and 2008, climate change brought about global yield declines of 3.8% for maize, and 5.5% for wheat. For every 1°C increase in growing season temperature, wheat production decreases by 6.0%. Low productivity of soybeans, prevailing droughts, low yields, and technical difficulties experienced by the crushing industry remain significant challenges for this fast-expanding crop in South Africa. In this regard, yield improvement is expected to be the most significant driver of agricultural production.

Pulse breeding programmes

South Africa does not yet have any pulse varieties that are tolerant to heat or drought. The local breeding programme has focused mostly on biotic stresses such as disease and pests, which have always been major constraints to production. Significant progress has, however, been made in South Africa in improving disease resistance. Initiatives include a collaborative research project with the US Department of Agriculture Feed the Future project to address heat and drought tolerance, and the following progress has been reported:

- An Andean Diversity Panel (ADP) was established which consists of approximately 700 entries (cultivars, lines, germplasm) as part of the project. These varieties were entered from breeders and collaborators globally. The Andean beans are large seeded beans and lack resistance to many traits (the majority of resistance is present in Meso-American types or the small seeded beans).
- This panel has studied the resistance to biotic and abiotic stresses in many countries.
- The ADP lines were planted for drought tolerance at Potchefstroom during the 2014/15 and 2015/16 season, but as a result of late rains no significant results could be generated.
- Over the past season, a trial (approximately 3 ha) at Vaalharts in the Northern Cape was conducted where about 400 ADP lines as well as about 200 Durango Diversity Panel (DDP) lines were tested for heat tolerance. The DDP, which was developed especially for heat and drought tolerance, was able to generate excellent data from the trials. All the local cultivars were highly susceptible to heat and did not yield anything, but the panel was able to identify promising lines that could be used in the ARC's breeding programme to improve heat resistance. The results from these trials correlated well with results generated from trials in other countries.
- PIC lines *(Phaseolus* improvement) were also included in the trial. There were F4 populations from four-way crosses developed by crossing ADP lines with the most promising resistance to multiple stresses. Single plant selections were made that are currently being multiplied in the winter nursery at Makhathini. These lines will be included in the breeding programme for possible release. The PIC lines are distributed to countries in the Pan-Africa Bean Research Alliance (PABRA) for testing and release in the respective countries. The ARC's other activities in the PABRA network include:
    - Improvement of nutrient content of beans (Fe & Zn) and bio-fortification as part of the PABRA project
    - Seed systems: training of farmers to produce seed (not grain) and linking it to markets
    - Training of farmers.

Mitigating food shortages as El Niño drought worsens

The ARC continues to develop and transfer appropriate technologies to mitigate the impact of drought on smallholder farmers through the promotion and deployment of Drought TEGO™ Hybrids. Hybrids are drought and heat tolerant and are better equipped to tolerate disease outbreaks during extreme drought conditions. During a variety promotion in 2014/15 to create awareness of and product demand for drought-resistant hybrids, 10 000 seed packs of 500g were distributed to smallholder farmers in the Eastern Cape, Free State, KwaZulu-Natal, Limpopo, Mpumalanga and North West provinces. Small holder farmers who planted the cultivar reported obtaining increased yields. This meant that they were able to consume more maize at home and they could also sell maize to their communities as a basis for ensuring food security. Increased yields contribute to increased incomes, which in turn contribute to food security.

Conclusion

The ARC remains an R&D partner of choice in the celebration of the International Year of Pulses 2016. All interventions are geared to support the second UN Sustainable Development Goal 'to end hunger, achieve food security and improved nutrition and promote sustainable agriculture'. This concerns nutrition and includes an ambitious target of ending malnutrition in all its forms by 2030.

MARKET OPPORTUNITIES AND CHALLENGES WITH PULSES (Mr Dean Miller, Group Marketing Manager: AGT Foods Africa)

Background to AGT Foods

Mr Miller reported that AGT Foods is the largest supplier of value-added pulses and staple food and food ingredients worldwide. The company has 40 facilities globally with its headquarters in Canada, and

currently ships products to 32 countries. The South African division specialises in importing pulses that are not locally grown as well as operating in the seed industry. AGT's marketing adage worldwide is 'No soil no farmers, no farmers no farms, no farms no food, no food no nation'. Mr Miller advised that he would use the NSTF forum to discuss marketing opportunities and the challenges of those opportunities in the pulse industry.

Pulses refer to the dried edible seeds from plants of the legume family (e.g. dried peas, dried beans, dried lentils, dried chickpeas). Pulses are particularly suitable for today's health-conscious consumer, as they are naturally very high in protein, containing up to 25% more protein than traditional cereal crops and wheat.

The following factors are related to the marketability of pulses:

- **Demand:** Europe and other countries have experienced a huge demand for products incorporating pulses, as increasingly health-conscious populations look for more nutritious foods. Over approximately the last seven years in South Africa, AGT Foods has recognised the increased expectation and demand for pulses from supermarkets which is assumed to be due to the demand from consumers.
- **Lifestyle:** There is growing consumer interest in nutritious foods that are high in protein. The addition of pulses and pulse flours to products adds to the protein value of foods, while also enabling manufacturers to reduce the dairy and meat content of products. AGT Foods has resources in France and Canada that have extracted protein from lentils and peas which are added to substitute other products in certain foods (e.g. sauces, eggs).
- **Alternative plant-based sources of protein** are in demand as consumers increasingly consider them to be healthier than meat. Flexitarians (people who eat predominately a vegetarian diet but also meat) are fuelling the demand for protein-rich vegetarian foods as meat consumption is consciously reduced to meet financial constraints. Due to the recent drought in the country, it is expected that meat prices will rise considerably from August 2016, which will force South Africans to eat less meat.
- **Innovation:** The combination of savvy manufacturers and the emergence of a greater range of pulse-based ingredients, such as pulse flours and pulse protein concentrates, have helped to satisfy the growing demand for healthier, protein-enriched, vegan foods. New and existing ranges of snacks, bread, biscuits, cereals, batters and breading, pasta, soups and sauces that contain pulse-based flours and proteins can be used in the drive to provide more nutritious foods. Pasta is also now being made using lentils, which will be of benefit to people who are gluten intolerant.
- **Nutrition statements:** South Africa is particularly strict in marketing statements. Nutritional and health statements help differentiate products and improve their consumer appeal and commercial success. Consumers are becoming more aware of what they are consuming and are showing more interest in product ingredients such as protein, sugar, fat and carbohydrates. Adding pulses, pulse flours and proteins to products supports nutritional claims such as 'source of protein' and 'high-protein', and this appeals to consumer interest in protein-rich products. Pulse ingredients are naturally gluten-free and form an integral part of dietary guidelines in most countries. South Africa's food dietary guidelines endorse that people should eat dry beans, split peas, lentils and soya regularly, as pulses are a nutrient-dense food. Current evidence supports links between certain dietary patterns and the risk of obesity and chronic diseases, particularly cardiovascular disease, hypertension, type 2 diabetes and certain cancers. Pulses assist in the management of these diseases as they contain double the amount of protein compared with grain.
- **Affordability:** Currently in South Africa pulses cost approximately R1.50 per serving and remain the most affordable source of protein in developing and low-income countries.
- **Simplicity:** Pulses can help achieve a wide range of claims, including vegan, meat-free, kosher and halaal, to improve the commercial viability of products.
- **Environment:** Pulses are less taxing to cultivate and are economical on natural resources as they fix their own nitrogen and improve the quality of soil. Pulses such as cowpeas can be used in crop rotation, resulting in subsequent crops producing good yields, which in turn improves food security. Pulses also require less water in the production of the final product for consumers; they require only 160L of water per 500g of pulses, compared to approximately 7 000L of water per 500g of beef.

- **Uses:** Pulses can be milled into flour and used to enhance product texture (e.g. crispiness, taste and colour diversification). Pulse flours are easy to use and store easily for long periods of time, which makes them conducive to limiting wastage. Manufacturers, retailers, chefs and food services sectors are therefore increasingly using more pulse flours. Between 2014 and the first quarter of 2015, 428 new finished food products using pulse flours were launched.
- **Challenges**: Despite the agricultural, environmental, nutritional and health benefits of pulses, the trend towards the production and consumption of pulses remains low. Global yields of chickpea and pigeon pea (two grain legumes that play an important role in the food and nutrition security of the poor developing countries of Asia and Africa) are low and have been relatively stagnant over the last two decades. This trend has also been exacerbated by third-world countries being exposed to chain food suppliers such as McDonald's, which tend to supply unhealthy fast foods. Although the consumption rate of pulses in the poorest rural areas and lower- to middle-income groups rose between 2009 and 2010, it declined in the upper-middle class and highest-income groups. Furthermore, the supply of pulses has failed to keep pace with demand. Pulses are grown as residual, rain-fed crops on marginal lands with little or no modern yield-enhancing inputs. India is the prime contributor to these trends, where paddy and wheat remain the dominant crops. From an agricultural point of view, third-world country pulses are more susceptible to abiotic and biotic stresses, scattered production and consumption centres, and unorganised processing and marketing sectors.
- **Investment**: The discussion highlights the serious challenge immediately required in South Africa and sub-Saharan Africa for smart investment in technology, institutional arrangements and government policies to fight against hunger. In countries such as Canada and Australia, pulse-producing hubs have been established owing to favourable agro-ecological conditions, scientific farming techniques and streamlined market linkages.
- **Education:** Little has been done in the education sector and in the design of curriculums to highlight the importance of pulses to the youth. The UN has identified that in many regions, including southern Africa, young people between the ages of four and 14 are not being introduced to pulses and other important aspects of agriculture with the potential to sustain them and their families. Such education will ultimately boost productivity and assist in uplifting of rural areas and poorer income groups. Pulses are also known as 'orphan crops' and do not get the recognition they deserve.
- **Research:** There is a concern that not enough research is being done on pulses in South Africa and that funding set aside for agricultural research is not being used optimally. A new global survey has shown that researchers are concerned that the level of research funding for pulses is so low that it handicaps efforts to improve food security and agricultural sustainability. Orphan crops tend to be ignored by funders; however, R&D in an inclusive and sustainable manner is vital for the future of food security in South Africa.

Conclusion

The development of pulses needs to be achieved in an inclusive and sustainable manner. The health and economic needs of all individuals, communities and industry, and in particular the under-privileged, must be met. The transformation of industries and value chains with targeted and goal-orientated innovations, especially in the private sector, need to be addressed. Partnerships need to be created with business, government, civil society and academia. The affordability of pulses compared with meat needs to be communicated to communities and reference made to diseases such as cardiovascular disease, hypertension, type 2 diabetes and certain cancers. These diseases are taking huge funding from the health budgets of countries. This relates to the lack of education about food and food nutrition.

IYP 2016 is instrumental in raising the profile of pulses and enabling linkages between global and national pulse innovations.

WRAP-UP OF THE MORNING'S PROCEEDINGS: QUESTIONS/RESPONSES

Question – Mr Petje, DAFF: Why were environmental programmes not included along with social and economic programmes? When one defines sustainable programmes, the environmental programmes are vital for the production of food. If this is omitted, production will be affected, especially from an economic point of view.

Response – Mr Ndimande, DAFF: The policy architecture has been coined at the highest levels. The economic aspect is huge and hinges upon how we preserve our resources and how we utilise them in a more sustainable way. Environmental issues such as climate change, soil change, productivity and production are encompassed in the social aspect.

Question – Prof. Berger, University of Pretoria: It was mentioned that South Africa imports most of its pulses. This meeting is about interventions that could assist the future of the country. It was mentioned that in Canada and Australia, there are production hubs where the value chain issue has been addressed, and that pulses are high-risk crops with biotic and abiotic stress problems. What is your opinion on South Africa investing in a production hub or do you think the country should be investing in other aspects of the value chain?

Response – Mr Miller, AGT Foods: From an investment point of view, AGT Foods has put a huge amount of investment into trials on pulses, lucerne and mung beans. The problem is that in certain areas in South Africa the climate is not conducive to growing certain pulses (e.g. mung beans are produced in Botswana due to its climate).Trials have been done in South Africa which did not produce the desired results. From an integrated hub and linkage point of view, we would like the government and Minister of Transport to reintroduce rail transport for agriculture. South Africa had a good rail network that used to work very efficiently. Road transport has become expensive from the perspective of truck maintenance. The AGT Foods factory in Krugersdorp still has an old railway link that brought product from farms around South Africa, which was a far cheaper mode of transport. Obviously lower production costs will result in lower prices passing through to the consumer.

Question – Mr Mgiba, Justice and Peace, Witbank: It was mentioned that the country is occupied by more mines and that there is a lack of agricultural land for cultivation and farming. There was no mention of the huge sums that are spent on building shops and or perhaps that land should be preserved for farming and mining. What is government doing about this?

Response – Mr Ndimande, DAFF: A large amount of agricultural land has been lost to mining. I do not think there is a lack of agricultural land in South Africa. I was saying in my comparison that the 12% high potential agricultural land is mostly in Mpumalanga and much of it has been lost to mining. While mining is important to the economic climate of the country, it does not supersede the importance of food security. China does not touch agricultural land for industrial use. In South Africa fertile land has been lost to mining; however, other technologies could be explored rather than open cast mining that would allow minerals to be extracted while agricultural activities are undertaken above in the top soil.

Response – Ms Hendriks, Dry Bean Producers' Organisation: Mr Ndimande has told us about technology that is available to make it possible to undertake agriculture and mining simultaneously. Is this possible in South Africa?

Response – Mr Mgiba, Justice and Peace: I come from Witbank, where there is a lot of mining and some of the farming land has been bought out for mining. This land was previously used to cultivate maize and corn. Has government considered that open cast mining flushes away the rich soil that contains water?

Response – Mr Ndimande, DAFF: I am not a geologist, I am a mining engineer. In my view there are a lot of mining technologies that South African could explore rather than using agricultural land. The geology and geographic locations would need to be considered in undertaking such investigations.

Question – Ms Mgangira, EU: Mr Miller spoke about the importance of education to youth and Ms Tang spoke about indigenous knowledge. Do your organisations have any strategies that focus on education and indigenous knowledge as far as the importance of pulses is concerned? It is very true that the youth have detached themselves from pulses. In most traditional South Africa societies, pulses are considered as only being fit for the poor and meat is believed to have more nutritional value. We need to focus on how to reach the youth to impart indigenous knowledge as well as the general knowledge that we should

be teaching at basic education level and I would suggest that we start collaborating with the Department of Basic Education to educate the youth on nutrition. This generation is missing out on important dietary facts, because cultural differences are not taken into account. People should be educated to consume bean products daily.

Response – Ms Tang, DST: We have many strategies related to awareness and education. The IKS policy was discussed, and the development, promotion and protection of indigenous knowledge. One of the educational strategies we have developed is a specific bachelor degree in IKS together with the universities of the North-West, South Africa and KwaZulu-Natal. We are still investigating a lower level of education in IKS. The programme started in 2013 and the aim is to introduce this degree into all universities.

Response – Mr Miller, AGT Foods: Since 2013, AGT Foods together with the Global Pulse Federation started curriculum-based school lesson plans, of which there are already six in existence. These plans can be used worldwide and can be integrated into existing curriculums per country throughout the world or as an add-on if such a curriculum already exists. The curricula are specifically developed for the ages of eight to 11 and are freely available from the pulses.org website. We met with the NSTF and DST and they were particularly interested in the curriculum developed by the UN. They plan to take this forward in their road shows to science centres throughout the country. It is hoped that this will get around the bureaucratic difficulties, for now, of engaging the DBE in integrating the programme into school curricula.

Question – Head of Research, Free State Province: I am concerned about how long it takes for policies and legislation to be approved. We need to consider why. Policies and directives are essential for the nation to be synchronised. Obviously there are challenges with pulses as a commodity that need to be communicated to the nation. The country needs to know both the positives and the negatives.

Question – Ms Mphumbude, DAFF: It was mentioned that amaranthus is now being used in Maggi Two Minute Noodles. Although this is a very good initiative, I am concerned that the content of amaranthus is only 4%. I would like to see this percentage being increased to balance the nutritional value, as highly processed foods are not conducive to healthy eating, especially for children who are the largest consumers of these noodles.

Response – Mr Ndimande, DAFF: We must not wait for a political approval on policies, but as managers we should drive these policies and implement them where possible. There are a number of policies that have been approved by government that have not been funded and implemented. Those in both the public and private sectors need to implement our beliefs. It is my opinion that politicians wait for us to lead them, and we therefore have to take the initiative.

Response – Mr C Kleingeld, Dry Bean Producers' Organisation: Three crucial issues have been raised. The first is that we must accept that we live in a constantly changing world, making it difficult to determine the future path. One example is pea beans, which we know as baked beans in South Africa. Two years ago the world price was around the US$1600 per metric ton. There was a worldwide shortage of pea beans and countries were aligning to make provision for that in their planning. The US Dollar price of pea beans today is only a third of that price.

The second point is education; children do what they see, not what they are told. If we want to have an impact on the habits of communities, we need to show them what to do. In this regard, I refer specifically to the use of pulses in the country, where there is a total mismatch to the production of this crop. Pulses are eaten predominantly in the Eastern Cape and KwaZulu-Natal; however, these environments are not conducive to production. Efficiency determines a forward path and is sorely needed in our country.

Thirdly, legislation in South Africa needs to be addressed. An example of this is that South Africa's main competition in pulses is China. In South Africa, the total road load is legislated at 34 tons of product, whereas China allows 110 tons per load. They travel a distance of 2 500 kilometres from where they produce to where they process. We need to see if we can find common ground to align expectations in order to move forward with a pilot discussion such as this today on pulses.

Question – Ms Motete, ARC: It was mentioned that South Africa has no drought- and heat-resistant cultivars. Does this also pertain to mung beans and cowpeas? If these are included in your programme, and because we are developing IKS, could we get that information to incorporate into the system?

Response – Dr van Vuuren, ARC: It is my understanding that regional or native varieties are used to get resistance traits and that this information is back-crossed into the pedigree lines from which selections are made. Gene mining is done globally, and I would be surprised if South Africa does not do local gene mining as well. I know that comprehensive screening programmes for native traits are undertaken where they look at the original sources of those traits and which are incorporated into the pedigree lines. Further information could be obtained from the ARC's Summer Grain Centre in Potchefstroom.

DAY 2

PLENARY PRESENTATION: CURRENT LEVELS OF AGRO-PROCESSING INVOLVING PULSES IN SOUTH AFRICA AND THE PROMOTION OF AGRO-PROCESSING OF PULSES AS AN INDUSTRY (Ms Unati Speirs, Head of Business Unit: Agro-processing and Agriculture, Industrial Development Corporation)

Ms Speirs reported that the key role of the IDC is to enhance the industrial capability of South Africa, and the rest of the African continent, and to boost economic growth and industrial development. This is done by funding entrepreneurs starting new enterprises or by supporting companies that want to extend their existing operations. Financial intervention at production level improves operating capacity at processing level, which in turn places a downward pressure on the prices of both final products and by-products for the benefit of consumers and related industries such as poultry.

Ms Speirs is responsible for 240 000 tons of chicken processing in the South African market. South Africa currently manufactures approximately 50 000 tons of chicken but remains in a deficit of approximately 30 000 tons. Pulses must be planted in order to improve the quality of the soil, which will result in the production of better quality crops that can also be used for chicken feed.

The IDC promotes value-adding expansionary agro-processing activities to primary agricultural production, which fosters economic transformation and inclusivity. The industry development goal is determined by competitive processed foods, beverages and other derivatives that optimally utilise and develop local resources and/or regional resources to supply the domestic demand and to increase participation in international trade.

A country's performance is measured by three aspects. One is the trade deficit which is when the cost of a country's imports exceeds the value of its exports, and this needs to be constantly measured. The second is the gross domestic product (GDP) which is the monetary value of a country's finished goods and services produced within the country's borders in a specific time period. The third measure is employment.

The IDC wants to grow the food and beverage industry. In order to achieve this, one needs to look carefully at the balance between local and imported products in the industry. South Africa must endeavour to create its own products, as this will create employment, which in turn will create skills development at all levels. The IDC has a long-term plan in food cropping, but the country must first ensure that it is self-sufficient. There are challenges that need to be addressed, including industry costs, land policy and access to water rights. Input costs (e.g. fertiliser, energy, water) must be reduced in order for the country to become more self-sustaining and for farmers to contribute to the food security of the country. The IDC recognises the importance of research and processing, as this will ultimately result in the country not exporting its raw produce and buying back finished products.

Challenges currently being addressed by the IDC are:

- Investment in soybean needs to be stimulated, as this will encourage investment within the local soybean value chain. It will also assist in alleviating dependence on imported soybean and soy meal.
- Local production of sorghum and barley needs to be stimulated to support the emerging bio-fuel and malting industries respectively.
- Partnerships with processors must be in place to support emerging farmers to grow and move production to commercial scale.
- Storage facilities in rural areas need to be developed, as do new disease-resistant and adaptable varieties of seed.

The roles of critical stakeholders in addressing these challenges are:
- Government must ensure that policies regulate and protect public investment in infrastructure, which in turn will enable a positive investment climate.
- The IDC will facilitate investment in the industry after having selectively focused on various sectors.
- Industry associations will enhance overall industry growth.
- Farmers will be the drivers of investment.

The need for all partners to work together to develop the farming and production of pulses is crucial for the country's survival and food security, as a self-sufficient nation is a happy and healthy nation.

Discussion

Comment – Ms Niehaus, NSTF: Three aspects that have not been discussed include bio-fuel, soybeans and chicken feed, and understanding their connection with pulses.

Response – Mr Snijman, ARC: By definition, soybean is not regarded as a pulse due to its oil content. Soybeans are regarded as an oil seed and hence this product has not been discussed in this forum. Although most pulses can be used for animal feed, the seeds themselves are not suitable for animal feed. With reference to sorghum, it is interesting that this product is regarded as a game changer in the industry, because where pulses are produced there is an opportunity to produce sorghum. I ask government departments and communities, especially in the North West and Limpopo provinces, why they are not producing sorghum. I can only conclude that sorghum is regarded as an inferior crop that bears no substance, as it is extremely suitable for warmer climates. South Africa is heavily involved in the white bean industry, but due to inefficiencies in production the country cannot compete internationally in terms of price. It seems that the country is being held ransom by import parities, which could negatively impact on the value chain of that commodity (and others).

Response – Ms Speirs, IDC: In crop production, improvement in technology is vital. This entails scientific research. Sorghum is a good alternative crop to pulses as it can be planted anywhere, it is cheap to produce, and it remains as important a crop as pulses. With regard to import parities, there are two aspects that can be addressed in the market. One is to apply a tariff on a product and the second is to undertake own production, which is known as support market. However, this is not favoured in the world market. People must have knowledge of the product that they market. It is unlikely that many of the maize traders, for example, have actually studied agriculture.

Response – Prof. Linington, UNISA: Thank you for linking science and agriculture. People tend to think that for farmers, 'farming is in their blood' and they do not need education in farming, but good agriculture is linked to good science.

TRACK A: CULTIVATION OF PULSES – Panel: Mr K Petje (DAFF), Mr W Snijman (ARC-GCI), Dr IA Hassen (ARC)

The panel showcased two presentations:
- Capacitating emerging farmers to play an effective role in the food production chain : Mr Snijman
- Agricultural Research Council: Biological nitrogen fixation in legumes : Dr Hassen

Mr Petje reported on the proceedings and findings from Track A.

Capacitating emerging farmers to play an effective role in the food production chain
The ARC held workshops with farmers on food production training in the cultivation of pulses for rural households in Limpopo, Mpumalanga and the Free State in which sugar beans were used for the trials. The outcome of this research and training showed that the farmers profit from their cooperation in these events and that this had also exposed them to the commercialisation and marketing of their products. The research showed the importance of involving farmers in the planning and maintenance of their farms. Farmer assistance should be implemented at government level with the assistance of public and private institutions.

The major constraints that hamper farmers in making a significant contribution are poor seed/input supply systems, poor mechanisation support systems, low levels of knowledge, low soil fertility and high production risks. The trials also revealed that mono-cropping had resulted in soil nutrient depletion and poor crop performance and that this could have been alleviated if the nitrogen content of the soil had been fixed. The areas portray a history of repetitive maize production that has resulted in the neglect of legume crops, which highlighted the need for the revitalisation of legume production. Furthermore over-grazing had prevailed due to the lack of fencing/boundaries.

Recommendations
- Farmers need to capitalise on technological advancements.
- Industry must create effective input/output market opportunities.
- Research organisations need to provide information and develop technology for the production of pulses in participation with farmers.
- Training and education needs to be addressed through ongoing on-farm trials and demonstrations.
- Government and public and private institutions need to invest in the monitoring and evaluation of farming activities and provide training and assistance on an ongoing basis to ensure the country's food security going forward.

Agricultural Research Council: Biological nitrogen fixation (BNF) in legumes
Nitrogen fixation is essential for all organisms and is found in all fertilisers. Pulses have a high nitrogen requirement for protein synthesis and should the soil be lacking in nutrients, large quantities of inorganic fertiliser would have been required. Legumes, including pulses, and especially chickpeas, faba (or fava) beans and cowpeas, are excellent crops for the fixing of nitrogen. The planting of these crops produces the best natural, organic fertiliser and maintains genetic stability. Most legumes have very good root systems that access not only nutrients, but also water. Mineral deficiency is a widespread problem in many parts of South Africa and hence the growing of cowpeas and other pulses should be encouraged. The need for constant research on the fixing of nitrogen was stressed. This can only be achieved by research, the findings of which would need to be passed on to farmers and producers. In South Africa, soybeans for instance show no indigenous strains of rhizobium. Rhizobium assists in legume nodulation, which results in increases in crop yields to desired levels to maintain genetic stability. However, the addition of rhizobium is not always applicable for some legumes, and in some instances could jeopardise the process of nodulation. Unutilised nitrogen fertiliser carried over from previous cereal crops can negatively influence BNF. The level of nitrogen fixation is commonly low in pulse crops grown in rotation with fertilised maize, and therefore the recommended level of nitrogen ranges need to be carefully determined. In order to secure the future of the country's food security and to be competitive in the world market, pulse production needs to be continually improved, which highlights the importance of improving input technology and general husbandry.

Recommendations
- It is generally accepted that the alleviation of poverty in Africa needs its peoples to be properly fed and to generate products that can yield income. With modern technology for improving plant and rhizobial germplasms, better exploitation of native legumes for both of these purposes is achievable.
- It is crucial that pulse BNF research receive attention. There is a need for investment in rhizobium inoculation technology. To this end, participation through public and private partnership is crucial. An

effective BNF dissemination strategy needs to be communicated to farmers and capacity building along the BNF value chain should be pursued through partnerships with research and academic institutions in developed nations.

- It was recommended that a geographical audit of pulse production be undertaken in order to determine which pulse crops should be grown in the various areas, whether this production should be by commercial or small farmers, and whether South Africa should privatise its pulse production or import the product. This would result in the need for long-term investment in DNA technology to deal with the resistance of pulses to drought, disease and pests and to yield improved varieties. Further research on rhizobium for biological nitrogen fixation is required in order to obtain better investment for pulses.
- It was recommended that a dedicated committee for pulse production be established with all interested parties and target dates be set to achieve the milestones agreed in order to submit a report to Cabinet on pulse production in South Africa going forward.

Discussion

Comment – Ms Niehaus, NSTF: The ARC and DAFF have researched seed from rural areas to determine which seed is most suitable for certain areas. Venda and Limpopo are already producing their own seeds for mung beans, bambara groundnuts and dried beans. The intention is to research all pulses.

Question – Prof. Mariga, University of Limpopo: My concern is that orphan crops will remain forgotten and that we will remain stagnant in our endeavours to promote pulse production.

Question – Ms Niehaus, NSTF: How do we promote indigenous pulses? Development projects have been undertaken on the cultivation of indigenous pulses. There is research on their nutrition but there is no promotion and public awareness of pulses.

Response – Mr Snijman, ARC: The development of specific pulse crops is based on consumer demand. Due to financial constraints, it is difficult to allocate funding to R&D on products that consumers will not use. Proposals would need to be submitted to motivate R&D on certain crops.

Response – Prof. Mariga, University of Limpopo: Limpopo grows bambara groundnuts, which are processed and marketed by NTK. Has any research been done to determine the best pulse to grow in this region?

Response – Mr Snijman, ARC: The consumers of bambara groundnuts must initiate the request for the funding of R&D for that product, whereafter the ARC will undertake the work together with relevant research institutions that are involved in the development of seeds.

Response – Unknown: The University of Pretoria has an Institute for Food, Nutrition and Well-being, which has done surveys on consumer food preferences. The topic of the marama bean arose from one of these surveys. The institute provides information and data on what consumers want, the nutrient levels of the various foods and which crops are being focused on.

Response – Mr Petje, DAFF: We need to market our produce in order to sell it and make a profit.

Response – Mr Miller, AGT Foods: I am pleased that the word ‘orphan pulses’ was used. Government and the DBE must institute pulse information into school curriculums so that that they do not become orphans and forgotten about. If this information is passed onto learners at a young age, their interest in the product will automatically grow.

Response – Ms Niehaus, NSTF: I was at the DST Food Safety & Security conference held recently in Johannesburg. It was extremely interesting to see that the Zimbabweans are promoting bambara groundnuts. There were five presentations on bambara groundnuts at that conference, but not one presentation on this product from South African researchers.

Response – Prof. Mariga, University of Limpopo: Ninety per cent of all Limpopo farmers grow bambara groundnuts. Why is this seed not receiving the attention and focus it deserves?

Response – Unknown: I come from Venda where one of the staple foods is bambara groundnuts, but this product is difficult to find and it would appear that bambara groundnuts are not even grown in this area, resulting in the community using dry beans and maize.

Response – Mr Kleingeld, DPO: The total production of bambara groundnuts in Africa amounts to 130 000 tons and is one of the main crops in Limpopo and Zimbabwe. Although the main advantage of bambara nuts is that it is a low input and sustainable crop that can survive with little water, in times of good rains other crops such as dried beans will yield a better output than bambara groundnuts. Hence the profitability of dry beans, for instance, compared to bambara groundnuts is approximately 25% to 30% higher. There is currently no commercial drive for bambara groundnuts, as the demand is low and therefore producers do not focus on this crop. Transport costs and load allowances also affect the cost of the product. In terms of food security, split peas are in high demand; whereas split dried beans are not being sold as consumers do not want them. There is no difference in the nutritional value of split peas or beans compared to whole peas or beans.

Response – Prof. Mariga, University of Limpopo: This forum is hoping to promote pulse production. After the Lesotho drought, the South African government provided aid to Lesotho to procure maize on small farms. Why is this type of assistance not being afforded for the production of bambara groundnuts? It should be a focused agenda item in discussions going forward.

Response – Dr Mabhaudhi, University of KwaZulu-Natal: I have been listening to the debate on bambara groundnuts. I have my PhD in this product and I serve on the steering committee of the International Bambara Groundnut Network. The bambara groundnut is a crop with much potential as it is high in nutrients and extremely drought tolerant and stress tolerant. The challenge of this crop and other under-utilised crops is that seed supplies are low, as producers say there is insufficient demand to justify seed production. Marketers argue that there is insufficient post-harvest technology. There is a project currently being undertaken in six countries, including South Africa, where a number of varieties of bambara groundnuts are being explored. Bambara groundnut yields are very low, with the average yield amounting to 1.5 tons per hectare, and the seed quality is very erratic. This necessitates the need for the development of the value chains and for multidisciplinary research teams and marketing partners. In terms of economic development, Memoranda of Understanding need to be entered into with farmers in poorer areas in order to source product and to develop varieties. This will result in farmers realising not only an income, but youth who do not wish to be involved in farming could become involved in the post-harvesting stages of marketing and logistics. This would assist in future food security in southern Africa.

Response – Dr Hassen, ARC: Bambara groundnuts are not discussed in many scientific conferences in southern Africa and not much research has been done on bambara groundnut nitrogen fixation. Breeding programmes are required to find solutions to nitrogen traits and fixing in South Africa and to develop varieties that are conducive in the South African climate.

Response – Mr Snijman, ARC: With regard to research, it must be borne in mind that the ARC is not a money-generating business. In order for research to be undertaken, it is essential that funding for the research has been secured from government. It is my opinion that while the bambara groundnut is crucial to food security in rural areas, it will not unlock the economic potential of those areas. The needs and expectations of what the country would like to achieve in terms of food security must be aligned in order to achieve the aims. Cabbage crops are profitable, but cabbage does not play a significant nutritional role. However, cabbage crops do allow small farmers to generate an income from a very small piece of land.

Ms Niehaus commented that when crops are regarded as commercial commodities, they often do not meet food security needs, and vice versa. This needs to form the subject of separate discussions.

TRACK B: INDIGENOUS KNOWLEDGE SYSTEMS AND BIODIVERSITY – Panel: Mrs G Mabeba (DST), Ms T Prekel (SynNovation Solutions), Dr A Ndhlala (ARC), Dr J Sebola (SANBI)

Ms Niehaus reported that Ms Prekel had spoken about a book written by Renata Coetzee. The book is based primarily on the food culture of the Khoi people as it still exists and as it is remembered. It contains a wealth of information on edible plants such as succulent plants (e.g. aloes); however, this knowledge is dying out. Ms Prekel discussed four beans that are mentioned in the book, one of which is the marama bean. Research has shown that this bean has an exceptionally high content of protein and other nutrients, as do all pulses.

Dr Ndhlala spoke about the potential development of agro-processed products from indigenous/traditional pulses and vegetables in sub-Saharan Africa. South Africa is rich in botanical biodiversity, with an immense amount of unexploited wealth. Bio-fortification affords opportunities to add iron and zinc to plants such as maize, which would make them healthier to eat. This is done by genetic modification. Genetic modification is done by germplasm collections, whereafter the desirable traits are identified and selected varieties are bred.

Dr Janine Victor from SANBI addressed the panel on the taxonomy of legumes in South Africa. Taxonomy is a specialised skill and in order to record all the existing species, such scientific skills are essential.

Mr Kepadisa reported that there are many challenges facing South Africa in terms of pulses and food security, and that the lack of funding for research plays a key role.

Discussion

Comment – Prof. Mariga, University of Limpopo: Collaboration should not be restricted to government departments only, but should also involve universities and technical vocational education and training colleges.

Recommendations

- The proceedings of this conference must be shared with other government departments, including the Department of Agriculture, Forestry and Fisheries, the Department of Health and the Department of Social Development.
- People who are contracted by government to feed learners must be sensitised about the importance of healthy eating habits and incorporating pulses into those foods.
- It is important that the planting of school and backyard gardens be resuscitated.
- Centres of excellence need to be established around the country to deal with technologies in IKS and biodiversity. This matter should be raised with the DST.

TRACK C: MARKETING PULSES AND PRODUCTS, AND EDUCATION/AWARENESS ISSUES – Panel: Mr D Miller (AGT Foods), Mr C Kleingeld (Dry Bean Producers' Organisation), Mr C Joubert (National Agricultural Marketing Council SA)

Report back by Ms Fischer from the African Centre of Excellence for Information Ethics, University of Pretoria:

AGT Foods has marketing campaigns across 32 countries and with 11 partners in South Africa to run these campaigns, in which there has been considerable investment. South Africans need to start integrating the use of pulses into their day-to-day lives. In order for this to happen, awareness and information on pulses need to be passed on from producers, distributors and researchers to children, teachers and rural communities. A curriculum has been designed for school children that includes learner packs and facilitator packs; however, the transfer of this information to teachers and schools via the Department of Basic Education is a challenge. A solution to this problem is to hold workshops and to make the information available on the internet so that the transfer of knowledge can start happening at school level.

What opportunities exist to grow markets for pulses and their products?
The alignment of expectations between producers, distributors and consumers needs to be strengthened. Supermarkets do not share selling successes, which is not a conducive environment for providing information on what is being grown, sold and distributed.

The insignificance of Africa's production of pulses was highlighted. South Africa produces only 0.5% of international pulse production. The South African climate is conducive for growing pulses; pulses are water-savvy products and they provide nutrients to the soil. These factors support the recommendation that the country could be producing more pulses. The country could gain a competitive edge by producing its own pulses not only for local consumption but for export markets as well. There is a drive in South Africa for dry bean production, and the abilities and skills to do this are available. It was noted that the moisture level of dry beans in South Africa should not be above 15%, otherwise the product cannot be distributed and sold. China, however, allows a moisture level of 16%, and these beans are imported, distributed and sold. The South African market is therefore not being acknowledged, and in fact the international market is being supported at the expense of the South African market. South Africa should put incentives in place to support the local market and not allow such discrepancies in standards. It was suggested that the Department of Trade and Industry could play an important role in this regard. A further risk for bean production in South Africa is related to the climate and the window period for harvesting to production, which is between 21 and 28 days.

Trends in selected agricultural prices
Agricultural pricing is affected by the impact of global warming, the change in power positions in the global economy, the growing world population and urbanisation as well as the availability, affordability and accessibility of produce. The importance of information technology systems was reiterated. The South African Grain Information Service (SAGIS) gleans information from 800 service providers, and there are companies that collect this information which can be used for planning the planting of crops, production and distribution. This highlights the fact that the technical processes involved do not get the credit that they deserve.

Global warming has had an impact on the cost of food production, and this will impact on buying costs. It is essential to put a ten-year action plan in place as populations are growing, urbanisation is increasing, rural areas are depopulating, and production skills will be reduced. It has become apparent that young people are not as interested in commercial or subsistence farming as previously, and that the growth of skills in rural areas needs to be raised. This aspect, together with proper longer-term planning for South Africa in the production of pulses, needs to be addressed to ensure that the country becomes a competitive market both locally and internationally.

It was reported that countries such as Mexico, China and India, are gaining the edge in the production of pulses. South Africa is a member of the BRICS countries and it was recommended that science and research in terms of production be shared with member countries.

Recommendations
- A key issue for South Africa's future sustainability is to have a well-developed food system for which production should be characterised by regulatory certainty.
- Information should be accessible, and smart support and multipliers of production must be investigated.
- Producers in South Africa and Africa should be working together in terms of production and distribution.
- The country needs to take heed of the population's demands and start acknowledging and addressing these demands.
- The country needs to acknowledge the positive impact that pulses could have on the economy.
- Increased efficiency in production processes needs to be pursued in order for South Africa to become a competitor in pulses with countries such as China.

- Continued dialogues such as this forum must be undertaken regularly in order to bring knowledge and information to the fore and to combine and strengthen the different fields in the industry going forward.

Question – Unknown: What could be done in order for small-scale farmers to become aware of discussions such as this?

Response – Mr Miller, AGT Foods: Firstly, AGT Foods recommends that DAFF become involved in education on agronomy, climate and which planting areas are suitable for which crops. Secondly, the role of the private sector is just as important in educating small-scale farmers. The private sector needs to increase its participation in endeavours to educate these farmers. AGT Foods makes a large investment in the farming sector by regularly sending their agronomists to various farms.

Question – Unknown, DAFF: DAFF has programmes on production, and farmers' days are held to which the private sector is invited to promote their services. How can small-scale farmers get information about forums such as this?

Response – Ms Fischer, UP: Are farmers invited to the events? Do they have the means to get there? Is transport arranged? The University of Pretoria also holds conferences and workshops similar to this one, and takes books and printed information to these events, but they tend to be poorly attended. We want to share this information, but it does not reach the intended audience. Local communities listen to their local radio stations and perhaps one should rather focus on marketing events through this medium as well as television. The bottom line is that marketing is sorely lacking and budgets are constrained.

Response – Mr Snijman, ARC: From my personal experience of working with emerging farmers and the relevance of their skills, one must determine which market you want to reach. Farmers need to be individually identified who want to develop themselves and it is my recommendation that this is the direction DAFF should undertake. In saying this, consumers also need to be informed of pulses and their benefits.

Response – Unknown: One of the more successful means of communication and creating awareness in rural areas is the use of mobile phones. With the penetration of cell phones not only in South Africa but across Africa, people do have access to mobile technologies. Some companies use mobile technology for sending small messages and information, and this appears to be successful.

Recommendations from the forum

- DAFF was requested to use its extension officers to distribute information to small scale farmers.
- The use of radio and cell phones should be addressed by DAFF, as well as by the Department of Telecommunications and Postal Services (DTPS) and the Department of Basic Education (DBE).
- It was agreed that a round table meeting should be arranged between DAFF, DTPS and DBE. Mr Miller suggested that the dti be requested to attend the proposed meeting, as they would need to fast-track information-gathering and to set up a policy with regard to standards and the distribution of information throughout South Africa. Ms Niehaus reported that while the National Agricultural Marketing Council SA is to be applauded for their work with regard to the collection of data, she was concerned that people and companies do not talk to one another and share information.
- It was recommended that DAFF should address the matter of presenting available data and information to the public and investigating how this information can be distributed through mobile mediums. It was further suggested that the National Agricultural Marketing Council SA be approached to assist DAFF.
- Dale Vest (www.dalevest.co.za) in the Free State runs a free mobile app between approximately 21 000 farmers. This app is used for purposes such as advertising, and supplying and finding information about planting, which influences production and food security. It was suggested that the NSTF contact the company to arrange a meeting with them as this is an excellent means of communicating events and information to farmers.

THE WAY FORWARD

- Presentations from the forum will be placed on the NSTF website.
- The proceedings of the forum will be placed on the NSTF website with two weeks.
- The coordinating committee will compile a press release.
- The recommendations from the breakaway groups will be forwarded together with the report of the proceedings to the DST, DAFF and AGT Foods and also to selected government departments such as the DBE, DoH, DSD and DRDLR.
- Follow up action will most likely be by means of a roundtable discussion and details will be advised to all parties.

Ms Niehaus advised that the UP African Centre of Excellence for Information Ethics would be hosting a fully-funded conference for 100 people in East London from 2 to 4 November 2016 to which 30 international delegates from Africa had been invited. One of the platforms at the conference is to discuss food security and sustainability. Interested parties are requested to advise their interest.

Ms Fischer advised that the African Centre of Excellence for Information Ethics works with UNESCO, which runs the Information for All Programme (IFA). The centre of excellence is involved, as information plays a crucial role in food security and sustainability.

DAFF is funding the Institute for Developmental Assistance Management at the University of Fort Hare.

CLOSURE

Ms Niehaus thanked all attendees, presenters and panel members for their contributions to the discussions, and the coordination committee responsible for the programme content.

ANNEXURE A: ACRONYMS

AgriBEE	Agricultural Broad-Based Black Economic Empowerment
ARC	Agricultural Research Council
BNF	Biological nitrogen fixation
BRICS	Brazil, Russian Federation, India, China, South Africa
CBO	Community-based organisation
CSIR	Council for Scientific and Industrial Research
DAFF	Department of Agriculture, Forestry and Fisheries
DBE	Department of Basic Education
DPO	Dry Bean Producers' Organisation
DoH	Department of Health
DPME	Department of Performance Monitoring and Evaluation
DRDLR	Department of Rural Development and Land Reform
DSD	Department of Social Development
DST	Department of Science and Technology
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
FNS	Food and nutrition security
IDC	Industrial Development Corporation
IKS	Indigenous knowledge systems
IPF	International Pulse Federation
IYP	International Year of Pulses
MoU	Memorandum of understanding
NGO	Non-governmental organisation
NRF	National Research Foundation
NPFNS	National Policy on Food and Nutrition Security
NSTF	National Science and Technology Forum
OPV	Open-pollinated variety
PABRA	Pan-Africa Bean Research Alliance
R&D	Research and development
SABS	South African Bureau of Standards
SADC	Southern African Development Community
SANBI	South African National Biodiversity Institute
SARS	South African Revenue Services
SMME	Small, medium and micro enterprise
TFP	Total factor productivity
the dti	Department of Trade and Industry
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNISA	University of South Africa
UP	University of Pretoria

ANNEXURE B: LIST OF PARTICIPANTS

Name	Organisation
Mr Dean Miller	AGT Foods Africa
Dr Nthabiseng Motete	Agricultural Research Council (ARC)
Miss Cleo Molepo	ARC
Mr Koketjo Lekoane	ARC
Mr Pilot Nchabeleng	ARC
Dr A van Vuuren	ARC
Ms Hendrieta Moletsane	ARC
Mr Thabiso Mudau	ARC
Mr Wikus Snijman	ARC, Grain Crops Institute
Dr IA Hassen	ARC, Plant Protection Research Institute
Dr Ashwell Ndhlala	ARC, Vegetable and Ornamental Plant Institute
Miss Hulisani Malinda	Department of Agriculture, Forestry and Fisheries (DAFF)
Miss Moloko Mojapelo	DAFF
Mr Joseph Mahlabe	DAFF
Mr Kgomoamogodi Petje	DAFF
Mr Sibongiseni Ndimande	DAFF
Mr Shonisani Magwaba	DAFF
Mr Mathala Mokwele	DAFF
Miss Lindiwe Mgobhozi	DAFF
Miss Mmaserame Macucwa	DAFF
Miss Nandipha Mgijima	DAFF
Miss Patience Mphumbude	DAFF
Mr Khathutshelo Maedza	DAFF
Mrs Daphney Bodibe Marabe	DAFF
Ms Cynthia Mapatlare	DAFF
Mr Kossam Dongo	Department of Agriculture and Rural Development and Land Administration (Mpumalanga Provincial Government)
Mr Thapelo Kepadisa	Department of Science and Technology (DST)
Ms Mammone Tang	DST: Indigenous Knowledge-Based Technology
Mrs Gaboile Mabeba	DST
Miss Lindiwe Gama	DST
Mrs Beaulla Mathebula	DST
Mr Chris Kleingeld	Dry Bean Producers' Organisation (DPO)
Mrs Carolin Hendriks	DPO
Mr Kambou Bissele	Embassy of Burkina Faso
Ambassador Mauricio Escanero	Embassy of Mexico
Ms Catherine Mgangira	European Union
Dr Tobias Takavarasha	Food and Agriculture Organisation of the United Nations (FAO)

Name	Organisation
Ms Duduzile Mkhize	FAO
Mr Steven Lazaro	FAO
Mr Raymond Ntshangase	FAO
Mr Sanele Dlomo	FAO
Mr Ivan F Muzondo	Geoinformation Society of South Africa (GISSA)
Nuala Lawlor	High Commission of Canada
Ms Sandra McCardell.	High Commission of Canada
Ms Unathi Speirs	Industrial Development Corporation
Ms Faieeza Hoosen	ITPC
Mr Themba Nzimande	Justice and Peace
Mr Malike Mgiba	Justice and Peace
Mr Rendani Ramugondo	Limpopo Department of Agriculture and Rural Development
Mr Christo Joubert	National Agricultural Marketing Council SA
Ms Jansie Niehaus	NSTF
Mr Phalasi Matsole	Rietfontein Agri Partners
Mr A Brian Bibbey	Rietfontein Agri Partners
Mr Laurens Bibbey	Rietfontein Agri Partners
Dr Janine Victor	South African National Biodiversity Institute (SANBI)
Dr RJ Sebola	SANBI
Prof. Heinz Prekel	SynNovation Solutions
Ms Truida Prekel	SyNovation Solutions
Ms Salma Salum	Tanzania High Commission
Prof. TL Nedambale	Tshwane University of Technology
Prof. Margaret Joan Linington	University of South Africa (UNISA)
Mr Daniel Mogale	UNISA
Dr Tafadzwa Mabhaudhi	University of KwaZulu-Natal
Mr Fhatuwani Nndwambi	University of Limpopo (UL)
Mrs Paulina Mabapa	UL
Prof. Irvine Kwaramba Mariga	UL
Mrs Liezel van der Waals	University of Pretoria (UP)
Miss Leandi Lottering	UP
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