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with the latest vehicles

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with plant nutrition

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in critical early hours

Livestock:
Housing for animal welfare

Agrifuture Conference 2019 preview – p7

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Cassava set to boost Cambodia's economy, says UN study

CASSAVA, THE SECOND largest agricultural crop in Cambodia after rice, has the potential for substantial social and economic gains if it receives the appropriate level of public commitment and investment, according to a study released by the United Nations Development Programme (UNDP).

Cassava is an important export commodity and an input to several industrial processes, the study noted. Its development offers both output gains and structural benefits to the Cambodian economy.

The study, entitled "Making the Case for Investment in Cassava," has suggested that compared with other sectors, the returns to an investment package of US$296mn in the cassava sector would be needed to kickstart the sector's transformation.

As stated in Xinhua, Mao Thora, Ministry of Commerce secretary of state, said that in the long-run, the government aims to emerge as the world's most reliable producer and supplier of cassava.

"It benefits Cambodia, particularly, through helping increase export and creates more jobs for now and the future, thereby reducing risky migration, improving farmers' living standard, and preventing them from falling into poverty," the minister added.

Image credit: Adobe Stock

Cassava is an important export commodity in Cambodia.

Fresh hops sent to Korea for brewing

YAKIMA CHIEF HOPS (YCH), a global hop supplier, has exported the largest shipment of freshly harvested hops from the Pacific Northwest to South Korea in one day for the first time in brewing history.

Providing brewers on the other side of the globe with access to hops in their purest form is a huge milestone for the industry. With a mission to connect brewers worldwide with multi-generational family farms, YCH is focused on building strategic partnerships to increase the accessibility of hops for brewers everywhere.

The hops were used to brew fresh hop ales by three Seoul breweries and were released last month.

Because Fresh Hops are a highly perishable product that must be delivered from bine to brewer in 36 hours, they are typically purchased by breweries located close to the source, which are the hop farms of the Pacific Northwest where 75 per cent of the nation's hops are grown. Even American breweries face logistical challenges such as timing and brewing schedule coordination, making fresh hop ales a difficult beer to brew and a highly sought-after style.

Thanks to the YCH sales and logistics staff, the Washington State Department of Agriculture International Marketing team and Plant Services Program; Korean distributor, Brew Source International; and hop breeding partner, Yakima Chief Ranches, 720 pounds of Mosaic and Ahtanum brand Fresh Hops were successfully delivered to South Korea in one day.

Image credit: Adobe Stock

The hops were used to brew fresh hop ales by three Seoul breweries.

Asia-Pacific region must strengthen aquaculture governance, says FAO

THE ASIA-PACIFIC REGION is taking important preparatory steps to strengthen the governance of aquaculture for sustainable development and future food security, said the United Nations Food and Agriculture Organization (FAO).

Aquaculture has surpassed capture fisheries to become the major source of fish for human consumption in Asia. Total production of aquaculture reached 103 million tonnes in 2017 and that fish supplied around 60 per cent of food fish for human consumption. In 2017, the average per capita fish consumption in Asia reached 24 kg, contributing 23 per cent of animal protein in Asian diets.

FAO has collaborated with the Network of Aquaculture Centres in Asia-Pacific (NACA) through the convening of a regional consultation on strengthening the governance of aquaculture in Asia-Pacific to ensure sustainable development.

In preparation for the regional consultation, FAO and NACA have coordinated national assessment studies on the status of aquaculture governance in eight countries and developed a draft regional synthesis. More than 40 government officials and experts from 15 countries and a number of regional and international organisations are participating in the regional consultation.

The participants are reviewing comprehensiveness of current laws, acts and other regulatory instruments to safeguard the sustainable development of the aquaculture industry in different countries in the region.

Image credit: Adobe Stock

Aquaculture has surpassed capture fisheries to become the major source of fish for human consumption in Asia.

Innovating Japan's ageing agriculture with enhanced drone technology

Image credit: Adobe Stock

Around 27,346 ha of farmlands in Japan was served by multirotor crop-spraying drones in 2018.

TO COPE WITH the ageing farming population and shrinking agricultural labour, XAG and Bayer Crop Science have agreed to extend their collaboration on the application of IoT technology in the Japanese agricultural sector.

The two companies signed an exclusive business agreement on joint promotion of drone application technology in Japan in November 2018. In October 2019, XAG and Bayer held a joint news conference and reiterated that the partnership is primarily based on three pillars including business sales cooperation, drone spraying technology development as well as digital farming and digital solutions project utilising IoT technology.

According to a report from Japan Agricultural News, 27,346 ha of farmlands in Japan was served by multirotor crop-spraying drones in 2018, a 280 per cent increase compared with 2017. Rice, wheat and soybean account for 99 per cent of this operation area. However, due to complex terrains and lack of registered pesticides, automated spraying for vegetable and fruit trees on hilly and mountainous areas remains a major challenge for local farmers.

In addition to harnessing Bayer's consolidated sales network for distribution of XAG drones in Japan, the two companies are working on optimum spraying solutions that combine the unmanned aerial system (UAS) with innovative formulation technology. Building on Bayer's expertise in seeds and crop protection, XAG is set to adapt its drone technology to different varieties of crops and further enhance the spraying accuracy with UAS-specialised products for control of weeds, disease and insects and fertilisers.

ADB to develop agriculture and food safety in Nepal

THE ASIAN DEVELOPMENT Bank (ADB) has approved a US$50mn policy-based loan to help support the Government of Nepal's reforms to improve food safety measures, enhance agricultural trade standards, and promote agricultural commercialisation in the country.

"Agriculture has a big potential to contribute significantly to Nepal's growth and development, but the sector remains rooted on subsistence farming, and food safety measures are impeding the prospect of trade with other countries," said ADB senior public management economist Navendu Karan.

The Food Safety and Agriculture Commercialisation Programme, comprised of a two-tranche, standalone policy-based loan, will improve food safety and quality monitoring systems in Nepal, particularly in enhancing the regulatory and institutional capacity for sanitary and phytosanitary monitoring. This will include alignment with accepted standards for pesticide residue levels for fruits and vegetables, among others.

EVENTS 2019-20

DECEMBER 2019

2-3
Agrifuture Conference & Exhibition
Bangkok, Thailand
www.agritechnica-asia.com/agrifuture-conference

9-10
Agriculture Sciences and Farming Technology
Sydney, Australia
agri-farm.conferenceseries.com

JANUARY 2020

20-22
Ifex
Tokyo, Japan
www.ifex.jp/english

FEBRUARY 2020

7-9
FeedTechExpo
Ludhiana, India
www.feedtechexpo.com

24-26
FSHOW
Shanghai, China
en.fshow.org

MARCH 2020

16-18
Asia Forestry & Garden Machinery & Tools Fair (GMF 2020)
Guangzhou, China
www.yljxz.com

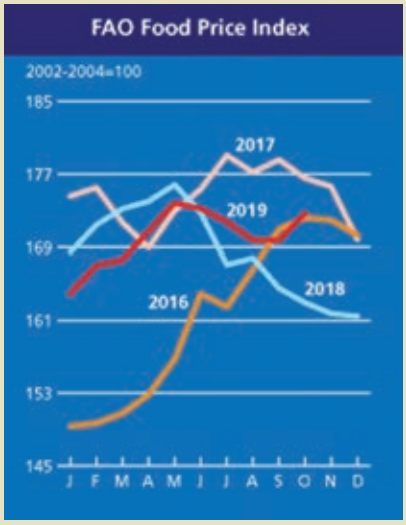
24-26
VICTAM and Animal Health and Nutrition Asia
Bangkok, Thailand
www.victamasia.com

FOOD OUTLOOK

THE FAO FOOD Price Index (FFPI) averaged 172.7 points in October 2019, up 1.7 per cent from September and six per cent higher than in the corresponding period last year. The increase in October marked the first significant month-on-month rise in the value of the Index since May 2019, as surges in the prices of sugar, cereals and, to a lesser extent, meat and vegetable oils, more than offset a small decline in the value of the dairy sub-index.

The FAO Cereal Price Index averaged 164 points in October, up by 4.2 per cent from September but still one per cent below its October 2018 level. International wheat prices moved up sharply in October, largely on robust trade activities and lower crop prospects in Argentina and Australia. Among major coarse grains, maize export prices also surged in October from very low levels in September, reflecting reduced crops in the USA and worries over planting conditions in Argentina, as well as a pick-up in export sales.

The FAO Vegetable Oil Price Index averaged 136.4 points in October, up 0.5 per cent from the previous month and marking the highest level since September 2018. The small month-on-month increase mainly reflects higher palm oil price quotations, which more than offset lower



values for sunflower and rapeseed oils. International palm oil prices rose for the third consecutive month, fuelled by firm global import demand and expectations of an output slowdown in leading producing countries, as well as news of higher biodiesel mandates in Indonesia next year.

The FAO Dairy Price Index averaged almost 192 points in October, down 0.7 per cent from the previous month, representing the second consecutive month of decline but still 5.6 per cent above its level in the corresponding month last year. The October decline was the result of notably lower quotations for cheese, more than offsetting increases in those for Skim Milk Powder (SMP) and Whole Milk Powder (WMP). Increased export availabilities in New Zealand were the principal factor behind the latest decline in cheese price quotations.

The FAO Meat Price Index averaged 182.7 points in October, up 0.9 per cent from September, representing the ninth consecutive monthly increase. International price quotations for bovine and ovine meats continued to rise, with buoyant import demand, especially from China, providing support. Quotations for pig meat also increased, albeit moderately, reflecting continued import demand in Asia despite seasonally increasing supplies from Europe and higher export availabilities in Brazil.

The FAO Sugar Price Index averaged 178.3 points in October, up 5.8 per cent from its reduced September average. The sharp rebound in international sugar prices in October was mainly underpinned by expectation of much tighter supply prospects in 2019/20. Latest indications point to a significant contraction in sugar output in India, the world's largest sugar producer, mainly because of a 10 per cent reduction in sugarcane planted area compared to the previous season.

Blockchain tool eMin to protect Thai aquaculture sector workers

DIGINEX, A GLOBAL blockchain solutions company, has signed a long-term agreement with Verifik8, a data intelligence and analytics provider for agribusiness suppliers, to help protect workers in Thailand's aquaculture sector.

Verifik8 will integrate blockchain-enabled tool eMin into its existing farming monitoring tools called Blue 8/Green 8, which are being used by 5,000 workers on the ground in Thailand.

This agreement follows the pilot with Verifik8 in February 2019, in which the tool was piloted at a shrimp farm in Phuket, Thailand. From the initial stages of the pilot, this project has been funded in part by the British Embassy in Bangkok, which has been a vocal supporter of finding new and inventive solutions to modern slavery, following the enactment of the Modern Slavery Act in 2015.

Verifik8's CEO Emmanuelle Bourgois said the initiative focuses on building an industry solution that enables an inclusive data ecosystem, reaching thousands of workers across farms in Thailand.

Coffee trade picks up in Vietnam

VIETNAM'S COFFEE TRADING has picked up slightly ahead of the main harvest expected from mid-November. The Indonesian market was down as the harvest season has passed, as reported by Reuters.

As some areas have started an early coffee harvest, market activities have picked up.

According to the source, coffee prices are seen to inch higher in the following weeks until fresh beans come in bulk. As some areas have started an early coffee harvest, market activities picked up after staying subdued since August.

In October 2019, Vietnam exported around 87,500 tonnes of coffee, which was down 5.3 per cent from September.

Harnessing agritech potentials

The spotlight will be on a wide range of topics such as increase of productivity, climate change, need for higher yield, labour shortage, new technologies and many others.

FROM THE ORGANISERS of Agritechnica Asia, the DLG (German Agricultural Society) and VNU Exhibitions Asia Pacific, Agrifuture Conference & Exhibition will take place in Bangkok, Thailand, from 2-3 December 2019. The format will be a one-day international conference, accompanying mini-exhibition, followed by a networking evening and a day of farm visits.

Bangkok's True Digital Park, Thailand's first and Southeast Asia's largest start-up and tech entrepreneurs' campus, will host the event, with the theme "Prepare yourself for tomorrow's agri-business." The event is expected to attract attendees involved in all sectors of agricultural production from across the region with its comprehensive conference and workshop programme featuring expert speakers.

Morning session topic: New Ag-Business opportunities

Dr Wolfgang H Pfeiffer of HarvestPlus, an International Food Policy Research Institute (IFPRI) programme will present "Catalysing biofortified food systems with partners in supply chain and market development." The focus will be on how to tackle malnutrition globally by breeding iron, zinc and vitamin A into staple food crops and build food systems through inclusive, sustainable markets.

Martin Gummert from the International Rice Research Institute (IRRI) will discuss "Value chain upgrading from harvesting to markets for sustainable rice production." Djaja Wisman, vice-chairman of Committee for Food Processing and Dairy Industry at the KADIN/Indonesian Chamber of Trade and Industry, will look at "Dairy farming in Indonesia, current situation and outlook in the next five years." Dr Dares Kittiyopas, president of the Thai Society of Agricultural Engineering, deputy director-general at Thailand's Department of Agricultural Extension and luminary of Agricultural Logistics of Thailand Research Fund, will discuss "Pre-conditions for smart farming in Southeast Asia."

Choice of afternoon topics

Five sessions for the afternoon presentation include:

- **Novel tools for smart crop management:** Dr Michal Levy, senior deputy director-general of Agricultural Innovation at the Israeli Ministry of Agriculture and Rural Development, will be talking about "Boosting agricultural innovation."
- **Innovations in sugarcane farming:** Michael O'Connor of Gessner Industries will examine "Mechanisation of Sugarcane Farms in SE Asia."
- **Laser levelling in rice production:** This will include a Round Table discussion with the title "Laser levelling in Thailand" moderated by the IRRI and Department of Rice, of Thailand's Ministry of Agriculture and Cooperatives.

Image credit: Agrifuture Conference & Exhibition

There will be an exclusive site visit to machinery manufacturer Kubota's experienced modern farm in Chon Buri Province.

- **Upcoming concepts for financing mechanisation:** Roland Treitler, financial advisor at German International Cooperation (GIZ), will highlight "Financial innovation for mitigation measures in the agricultural sector."
- **Vertical farming – The future of Asia's food security:** Assistant professor Dr Siriwat Sakhonwasee of Faculty of Agricultural Production, Thailand's Maejo University who will give a presentation titled "Upcoming trends in vertical farming."

Field visits to progressive farms

On the second day of the conference, there will be visits to selected farms, where experts will demonstrate and discuss the use of agricultural techniques and modern technology for optimising farming efficiency in various crops including rice, sugar cane, cassava, maize, oil palm and vegetables.

The highlight of the day will be an exclusive site visit to machinery manufacturer Kubota's experienced modern farm in Chon Buri Province. Kubota is Innovation Partner of the Agrifuture Conference, and delegates will be able to hear more about the company's vision to be a leader in farm and industrial machinery in Southeast Asia, with its Agri-innovative solutions helping farmers achieve a better and sustainable life.

The DLG's Katharina Staske, project manager of Agritechnica Asia, said that the new Agrifuture Conference & Exhibition had been introduced to complement Agritechnica Asia, which will take place for the third time from 7-9 May 2020 in Bangkok.

"Along with our international farmers' network, the DLG has expanded its relationship with farmers in Southeast Asia, including those in Thailand," added Staske. "It is through working with these farmers that we have come up with this new conference. It will focus on specific production areas that require targeted technical solutions, and will bring together farmers motivated by opportunities for knowledge acquisition." ■

For more information, please visit www.agritechnica-asia.com/agrifuture-conference

SCAN TO REGISTER

VIV Qingdao 2019 gets a 25 per cent visit increase

VIV Qingdao 2019, held from 19-21 September 2019, proved itself as a high-level international husbandry exhibition with the upgraded and renewed concept.

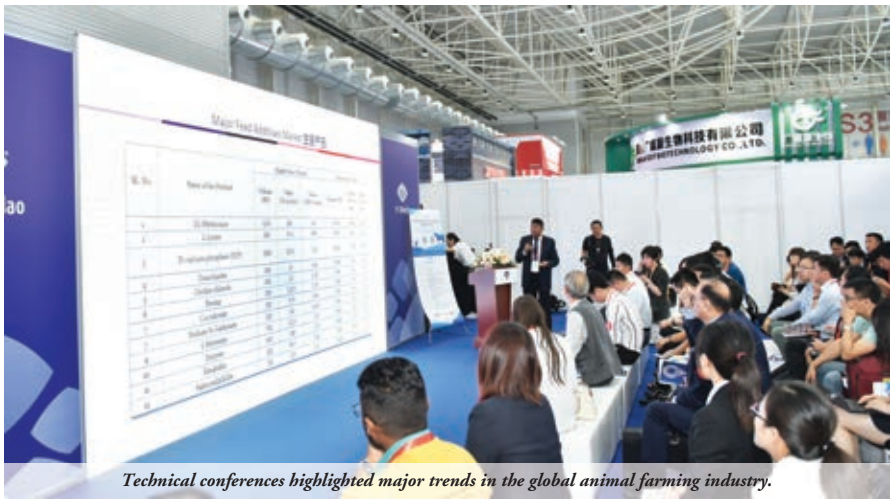


Image credit: VIV Qingdao

Technical conferences highlighted major trends in the global animal farming industry.

VIV QINGDAO 2019 and the co-current exhibition Asia Agro-Food Expo 2019 together attracted more than 1,000 exhibitors worldwide. There were more than 10 National Pavilions including the Netherlands, France, USA, Japan, etc with more than 20,000 agricultural brands from all over the world. Around 20,000 visitors attended on the first day of the show. Among them, overseas exhibitors and professional visitors accounted for 30 per cent.

Around 26 awarded innovative products were displayed in the InnovAction area in Hall S1 with sharing speeches by the representatives of the awarded companies. Rob Strathman, director of American institute of Famsun Co., Ltd., shared the latest expansion technology.

Technical representatives and senior managers of various companies including Adisseo Life Science (Shanghai), Recom (Qingdao) Biotechnology, Lifecome Biochemistry, Sinochem Yunlong, Shandong Haineng Bioengineering, State of Idaho China office, Shandong Longchang Animal Health Product and many others participated in the activity onsite VIV Qingdao 2019.

VIV Qingdao 2019 cooperated with Cargill to hold the conference theming at the African Swine Fever (ASF) prevention and control onsite the show.

Attention to hot topics and high-quality conferences

VIV Qingdao 2019 worked closely together with global prestigious industry associations including the Ministry of Agriculture and Rural Areas of the People's Republic of China, China Association for the Promotion of International Agricultural Cooperation (CAPIC), Food and Agriculture Organization (FAO), Embassy of the Kingdom of the Netherlands, Netherlands Agro & Food Technology Centre (NAFTC), the Poultry Institute of Chinese Academy of Agricultural Sciences and others to present high-end conferences and events which gathered top industry leaders from all over the world together to discuss the future development and to seek practical solutions.

Animal Disease Monitoring and Biosecurity Forum were moderated by Ina Enting, director of Dutch Meat and Feed Centre (DMFC) and the CEO of Netherlands Agro & Food Technology Centre (NAFTC). Dr Fuhao Fan of Quality Supervision and Testing Center for Breeding Pigs of Agricultural Rural Ministry (Guangzhou) gave the presentation on 'Specifications for Salivology Testing.' Chris Jackson, export director of British Pig Association and the UK Technology for Agriculture and Genetics gave the presentation on 'Policies and practices to prevent the spread of swine diseases in the UK.'

Chen Bin, chief engineer of Qingdao Xingyi Electronic Equipment, shared the implementation and exploration of "EI incubator 4.0." Lv Jianlong, director of Zhengchang Engineering Research Institute, gave the presentation on the exploration of feed technology and equipment for the future development trend of agriculture and animal husbandry feed industry. Wang Ruinian, product manager and the co-partner of Wepig Tech, shared on the progress and trend of AI tech in the pig industry.

Other parallel sessions of VIV International Summit focused on layer and egg; attaining antibiotics free Era; animal nutrition and others, gathering a wide number of professional experts and industry leaders.

The Second Farm and Food Integration Seminar themed at four major topics including macro analysis and exploration of consumer market; application of blockchain in agriculture and animal husbandry products; branding and new retail and business model and capital operation of the farming industry chain. Aidan J.Connolly, president of AgriTech Capital, gave the speech on the topic of "Digital technologies disrupting Agriculture; How innovation is transforming the way we grow, feed and process."

The Animal Health Industry Analysis Forum, organised by ECHEMI and VNU Exhibitions Asia, focused on the industry trend in China, Europe, Southeast Asia and Middle East market. Around 30 international buyers participated in the forum. Guided tour around the show and matchmakings were arranged as well.

The 2020 edition of VIV Qingdao will be held from 17-19 September. ■

Cultivating growth ideas for Malaysia's agricultural sector

Agri Malaysia, held from 26-28 September 2019, provided an effective platform to increase awareness of smart farming solutions while engaging with stakeholders from the value chain.

The event was organised by Expoglobe Sdn Bhd.

Image credit: Expoglobe Sdn Bhd

THE FOURTH EDITION of Malaysia's most professional agriculture trade exhibition, Malaysia International Agriculture Technology Exhibition (Agri Malaysia), received wide recognition from government organisations. These include the Ministry of Agriculture & Agro-based Industry (MOA), Ministry of Primary Industries (MPI), as well as the 18 supporting organisations and media partners ranging from government agencies to private sectors, from local to overseas, to support and connect industry-related stakeholders.

Around 9,707 local and international trade visitors attended the exhibition that was officiated by YB Dato' Teng Chang Khim, senior executive councillor, Selangor State Exco, Malaysia.

Incorporating Aqua Malaysia

The three-day exhibition incorporated the Malaysia International Aquaculture Technology Exhibition (Aqua Malaysia) to provide a complete aspect in agriculture, share useful market information and ensure worthwhile participation for all.

The exhibition was aimed to be the most professional and comprehensive aquaculture trade exhibitions dedicated to the local and international market players for an exclusive product and technology showcase. It was also shaped to be a learning hub for the aquaculture community that helped industry-related stakeholders to capture more market insights and enjoy greater mutual benefits.

Local and international participation

Covering a gross area of 5,772 sq m, Agri Malaysia included international participation from Malaysia, Singapore, Australia, China, the USA, South Korea, Taiwan, the UAE, Vietnam and Italy presenting around 460 brands under one roof, providing a comprehensive product and technology showcase covering agricultural chain solutions; precision agriculture and mapping; farm assist robots for multi-operation; smart farming and many more.

The day activities included 45 informative seminars presented by 47 local and international speakers from eight countries, to cover the topics of crops, plantation, farming and aquaculture.

> **"Agri Malaysia attracted around 185 exhibitors including international participation from Malaysia, Singapore, Australia, China, the USA, South Korea, Taiwan, the UAE, Vietnam and Italy."**

Featuring REDtone Smart Farming

REDtone Smart Farming offers flexibility in customisation to cater to the different types and sizes of farms in Malaysia. It delivers tailored solutions on an integrated IoT platform that allows farmers to leverage sensors, smart gateways and monitoring systems to collect information, control various parameters on their farms and analyse real-time data to make informed decisions. The ultimate aims of REDtone Smart Farming are increasing farming productivity and quality, reducing labour costs and maintaining the sustainability of the entire value chain.

"This provides an incredible platform for us to increase awareness of our smart farming solutions while engaging with stakeholders from the value chain," said REDtone Group CEO Lau Bik Soon.

The next edition will be held from 24-26 September 2020 at Setia City Convention Centre (SCCC), Shah Alam, Selangor, Malaysia. ■

Meeting housing requirements to boost production

Proper housing and management of animals are essential to animal well-being and to the health and safety of personnel.

THE ESSENTIAL ASPECT of sustainable livestock production is appropriate housing and in-house environment to promote health and high welfare for livestock species. Livestock housing design is fast-changing with a more professional endeavour, aiming to enhance animal productivity as well as promote the health of farmworkers, animal scientists, veterinarians, agricultural engineers and students.

Specific livestock operating practice depends on many factors that are peculiar to individual institutions and situations. Major housing management areas include feeding, watering, ventilation and waste management systems. Emission control, bedding, hygiene maintenance, managing in-house thermal and aerial environment are considered important aspects in animal housing design.

According to a paper by the National Academies of Sciences, Engineering and Medicine, many factors should be considered in planning for the adequate and appropriate physical and social environment, housing, space and management.

> **"Animals should be housed with a goal of maximising species-specific behaviours and minimising stress-induced behaviours."**

"The environment in which animals are maintained should be appropriate to the species, its life history and its intended use. For some species, it might be appropriate to approximate the natural environment for breeding and maintenance. Expert advice might be sought for special requirements associated with the experiment or animal subject (for example, hazardous-agent use, behavioural studies and immunocompromised animals, farm animals and nontraditional laboratory species)," according to the study.

Cows eating hay on a modern farm.

Image credit: Adobe Stock

Microenvironment and macroenvironment

The microenvironment of an animal is the physical environment immediately surrounding it – the primary enclosure with its own temperature, humidity and gaseous and particulate composition of the air. The physical environment of the secondary enclosure – such as a room, a barn or an outdoor habitat – constitutes the macroenvironment. Although the microenvironment and the macro-environment are linked by ventilation between the primary and secondary enclosures, the environment in the primary enclosure can be quite different from the environment in the secondary enclosure and is affected by the design of both enclosures.

Housing – primary enclosure

The primary enclosure (usually a cage, pen or stall) provides the limits of an animal's immediate environment. Acceptable primary enclosures allow for the normal physiologic and behavioural needs of the animals including urination and defecation, maintenance of body temperature, normal movement and postural adjustments, and where indicated, reproduction. It allows access to food and water and permits easy filling, refilling, changing, servicing and cleaning of food and water utensils.

"Primary enclosures should be constructed with materials that balance the needs of the animal with the ability to provide for sanitation. They should have smooth, impervious surfaces with minimal ledges, angles, corners, and overlapping surfaces so that accumulation of dirt, debris, and moisture is reduced and satisfactory cleaning and disinfecting are possible," the paper stated.

Sheltered or outdoor housing

Sheltered or outdoor housing – such as barns, corrals, pastures and islands – is a common primary housing method for some species and is acceptable for many situations.

When animals are maintained in outdoor runs, pens or other large enclosures, there must be protection from extremes in temperature or other harsh weather conditions and adequate protection and escape mechanisms for submissive animals. Houses, dens, boxes, shelves, perches, and other furnishings should be constructed in a manner and made of materials that allow cleaning or replacement in accord with generally accepted husbandry practices when the furnishings are excessively soiled or worn.

Naturalistic environments

According to the paper, areas like pastures and islands afford opportunities to provide a suitable environment for maintaining or producing animals and for some types of research. Their use results in the loss of some control over nutrition, health care and surveillance, and pedigree management. These limitations should be balanced against the benefits of having the animals live in more natural conditions. Animals should be added to, removed from and returned to social groups in this setting with appropriate consideration of the effects on the individual animals and on the group.

Temperature and humidity

Environmental temperature and relative humidity depend on husbandry and housing design and can differ considerably between primary and secondary enclosures. Factors that contribute to variation in temperature and humidity include housing material and construction, use of filter tops, number of animals per cage, forced ventilation of the enclosures, frequency of bedding changes and bedding type.

"In the case of animals in confined spaces, the range of daily temperature fluctuations should be kept to a minimum to avoid repeated large demands on the animals' metabolic and behavioural processes to compensate for changes in the thermal environment. Relative humidity should also be controlled, but not nearly as narrowly as temperature; the acceptable range of relative humidity is 30-70 per cent," stated the paper.

Ventilation and illumination

The purposes of ventilation are to supply adequate oxygen; remove thermal loads caused by animal respiration, lights and equipment; dilute gaseous and particulate contaminants; adjust the moisture content of room air and create static-pressure differentials between adjoining spaces.

Light can affect the physiology, morphology, and behaviour of various animals. Numerous factors can affect animals' needs for light and should be considered when an appropriate illumination level is being established for an animal holding room. These include light intensity, duration of exposure, the wavelength of light, light history of the animal, pigmentation of the animal, time of light exposure during the circadian cycle, body temperature, hormonal status, age, species, sex and stock or strain of the animal. ■

Image credit: Adobe Stock

Light can affect the physiology, morphology and behaviour of various animals.

Manipulation of plant nutrition to beat banana disease

Increasing volumes of innovative and interesting trials data and circumstantial evidence suggest a plant nutrition dimension can help manage Black Sigatoka disease through enhanced host plant resilience. Dr Terry Mabbett reports.

WHO WOULD HAVE thought that banana, the biggest of all bulk-fruit crops grown in the tropics, could be under a real threat of 'commercial extinction' from the disease? But be in no doubt because this could easily happen, especially for dessert bananas. Musa species (banana) is inherently and desperately short on genetic variability required for disease resilience, specifically the dessert banana export trade, which is almost entirely based on the Cavendish variety. What's more, the genetics of the Musa genus is complex and sufficiently so to make the development of disease-resistant and disease-tolerant banana varieties extremely difficult.

The first fungal plant pathogen to hit banana with a disease of survival-threatening capability was *Mycosphaerella fijiensis*. Black Sigatoka was first identified in 1963 and soon proved sufficiently aggressive to supplant its close cousin *Mycosphaerella muscicola* (yellow Sigatoka) as the major foliar disease in the banana growing regions of the world. Since then, banana plantations and estates have been sprayed with almost every conceivable fungicide to kill the pathogen and control the disease. Including sophisticated systemic curative fungicides with their site-specific (single-site) action and discovered, developed and marketed over the last half-century or more.

However, site-specific fungicidal action has turned out to be an Achilles' heel for systemic curative fungicides, leading in large part to their downfall caused by a propensity to select out strains of fungi resistant to their intrinsic chemistry. Banana growers faced with such problems are essentially wasting money spraying against a disease which is beyond the control of the fungicide chemistry being used.

Ironically the much older and generally less costly contact protectant fungicides with an inherent broad-spectrum activity, and shielding them from resistance development, are currently enjoying a renaissance and especially the 'oldest of the lot' which are the copper fungicides discovered 140 years ago. Over 60 years have passed since fixed copper fungicides like cuprous oxide were first used to control the Sigatoka diseases on commercial dessert banana crops. They were used in 'stand-alone' applications and later alongside systemic single-site action fungicides to 'cover' the latter against fungicide resistance development.

The plant nutrition dimension

The divalent copper ion (Cu^{2+}) which is the active principle in all copper-containing fungicides also has a vital role in plant metabolism as an essential micronutrient to present a 'double irony,' because 'manipulation of plant nutrition' now appears to be a novel pathway for Sigatoka disease management.

Image credit: Peter Prentis at Omex

Farmers find that bunch sprays of Omex Calmax and Omex DP98 alleviate the pressure on banana leaves from infection and disease development by Black Sigatoka to deliver bigger bunches, heavier hands and fuller fingers of banana fruit.

Increasing volumes of innovative and interesting trials data and circumstantial evidence suggest a plant nutrition dimension can help manage Black Sigatoka disease through enhanced host plant resilience. And to maintain fruit yields in face of an otherwise all-consuming foliar disease which reduces the photosynthetic capability and capacity of the foliage, leaving growers with smaller and lighter bunches of banana fruit.

Commercial dessert banana production is practised throughout the tropics in Central/South America, Africa and Asia. The Philippines is Asia's biggest exporter with 2.85 million metric tonnes out of a production total of 9.36 million metric tonnes in 2018. Cavendish cultivars account for 52 per cent of production and an even greater proportion of exports. The Philippines is just the sort of major banana producer/exporter where a plant nutrition dimension is needed to protect and preserve the industry and perhaps even save the country's export trade in dessert banana.

Specialising in leading-edge plant nutrition is Omex Agrifluids, a research and development-based UK (United Kingdom) company with unrivalled breadth and depth in its product portfolio, and as such, well placed to assist banana growers fighting black Sigatoka.

To discover what kind of work Omex is doing in cooperation with banana growers in The Philippines, I spoke with managing director Peter Prentis whose remit for research/development and marketing covers the whole of Asia. Peter describes the fascinating situation of a relatively small banana grower in the Philippines having secured his land from a multi-national banana producer, and

now successfully growing and producing good banana yields while others all around are increasingly constrained by Black Sigatoka disease.

"Standard practice in The Philippines is to cut out the diseased and necrotic areas of typically large banana leaves to curtail the spread of pathogen and disease," said Peter, "and clearly last resort to limit spread and preserve the photosynthetic capacity of as yet unaffected areas of the leaves. This particular grower is using Omex Calmax and Omex DP98 combined in a foliar spray and applied to banana bunches to harvest heavier and larger bunches of fruit. We know this because boxes are being filled with just five hands of fruit whereas previously it required eight hands of fruit to fill a box," noted Peter.

Ability to manage plant disease through crop nutrition is universally important and especially for the banana in which the profit margin for growers is so low. Calculations using dessert bananas sold in the UK supermarkets show growers receiving just over 20 per cent of the retail price, the same proportion received by the importer/ripener/retailer. Unlike chemical fungicides for which the only function and effect is a potential for disease control, positive effects of nutrient products on banana disease management are just a small part of their overall input into securing best plant growth and development and crop yield and quality.

How is the Omex DP98/Omex Calmax 'combo' working?

Omex Calmax is high in soluble calcium (22.50 per cent w/v) and already well established for enhancing structural resilience of plant tissue and susceptibility to disease in a wide range of harvested fruit and vegetables. Omex DP98 is high (37.50 per cent) in phosphorous but as the highly soluble phosphite nutrient as opposed to more usual and traditional phosphate.

Calcium is a vital element and plant nutrient with a structural role in calcium pectate which cements plant cell walls together to enhance overall strength and integrity of plant tissue, and thereby plant resilience to disease progression. However, calcium ions suffer from poor mobility to present difficulty in access and absorption by the roots even when there are ample calcium supplies in the soil, and also the movement of calcium ions inside the plant.

The water-soluble phosphite nutrient has biostimulant activity to assist entry of the inherently 'lethargic' calcium ions into the leaves and to help 'ferry' these divalent cations around the plant for efficient utilisation in a tissue-structure strengthening role. Evidence suggests this is exactly what could be happening in banana, with the combined foliar application of Omex Calmax and Omex DP98 conferring banana plant resilience to Black Sigatoka disease.

However, Black Sigatoka is not the only 'survival-threatening' disease confronting banana. Increasingly on the agenda to present an even worse pathogen/disease scenario is Tropical Race 4 (TR4) of the fungus *Fusarium oxysporum f.sp. cubense,* the cause of Panama disease of banana. This is even worse than Black Sigatoka because the systemic nature of this disease within the banana plant means it is effectively beyond the 'reach' and control of proprietary fungicides.

A frenzied investigation into the management of Panama TR4 is underway and including within the plant nutrition arena. Research findings at 'cellular level' have already indicated that the nature of banana root cell walls – structure, composition etc – can act as a barrier to the fungus which needs to pass this barrier to interact with living plant cells. Coordinated chemical responses within cell walls in response to an incursion by this pathogen have been demonstrated.

The plant cell wall material is composed of complex

Image credit: Peter Prentis at Omex

Farmers in The Philippines who regularly use Omex nutrient products inspect thriving banana plants on an estate previously condemned due to Panama Disease TR4.

polysaccharides such as celluloses and hemicelluloses together with associated proteins and aromatic compounds. Simple but essential to overall strength and resilience of plant tissues and plant organs is pectate. Pectate 'cements' walls of adjoining cells together and is known to play a pivotal role in stalling microbial infection and disease development within plants in general. The type and form of pectate performing this cell-cementing function is Calcium Pectate. A potential role for the calcium ion and nutrient (contained in Omex Calmax at 22.50 per cent w/v) warrants consideration and investigation. ■

Appropriate broiler management practices during early hours after hatching influence the final performance of the chicks.

Image credit: Adobe Stock

A chick's first 24 hours

Monitoring chicks in the critical early hours following hatch can prevent an increased percentage of early mortality.

THE GLOBAL TENDENCY to attain mass intensive broiler production practices with increased automation has led the newly hatched chicks open to numerous stressors in the first 24 hours after hatching, resulting in many adverse effects during the first critical hours, with an increased percentage of early mortality.

Appropriate broiler management practices during early hours after hatching influence the final performance of the chicks, result in attaining right body weights and increase in feed conversions and cost per pound of meat produced.

A paper written by Gary D Butcher, Amir H Nilipour and Richard D Miles from the University of Florida, stressed that sick, stressed, underweight, dehydrated or weak chicks will not perform to their genetic potential in a densely populated broiler house. Therefore it is then essential to ensure that the broiler farm has been decontaminated as much as possible. Implementing the right biosecurity measures play a crucial role to maintain the health and hygiene of the flock.

"The first 24 hours of the chick's life are the most important. The farms must be ready and inspected one day prior to the chick's arrival," noted the paper. Some of the basic parameters must be taken into consideration before and during the first hours of the chick's life to facilitate a good start and finish. These include:

Genetic improvements

The first week of the life of a modern, fast-growing broiler accounts for around 20 per cent of the broiler's life, compared with 10 per cent 20 years ago. This rapid growth rate puts more demands on management during the first week of life, leaving the broiler grower with less time to correct deficiencies.

Air quality

After biosecurity, the next most important factor is to provide good quality, warm, fresh air that is rich in oxygen for the recently hatched chicks.

"Chicks are often also exposed to formaldehyde gas and contaminated air during the hatch. It is important to ensure that air quality is optimum for the chicks on arrival and that it does not

> **"The broiler farm supervisors must understand how to manage the farms to provide warm, fresh air at all times, irrespective of outside conditions."**

> **Contaminated water can spread disease and cause diarrhoea, leading to dehydration and death in younger flocks."**

contain unacceptable levels of carbon dioxide and ammonia. Excessive amounts of these irritants can cause depression, dehydration, emaciation and eventually death," the paper demonstrated.

Brooding temperature

The broilers' production cycle is short. For approximately half of their life, broiler chicks have an immature thermo-regulatory system that cannot regulate internal body temperature when exposed to temperatures outside a relatively small range. Thus proper brooding is critical, and optimum growth during the first days of life will be dependent on the grower.

"Management practices should be modified depending on the actual climatic conditions and local geography. However, without exception all chicks must be provided environmental temperatures from 88°F–92°F for the first 24 hours," the paper stated.

Water

Contaminated water can spread disease and cause diarrhoea, leading to dehydration and death in younger flocks, making it imperative to check water quality, purity and temperature in advance. If the chicks have been in transport for a long period, providing water for the first three or four hours and then providing feed is suggested.

Many managers add some sort of sweetener substance, like sugar to the water for the first few hours of life. The sugar helps to replenish the depleted energy in the chicks and may stimulate the chicks to consume the feed. Adding a vitamin supplement to the water for the first three days of life may boost the chicks' vitality. With the exception of water vaccination time, drinking water must be adequately chlorinated, the paper stated.

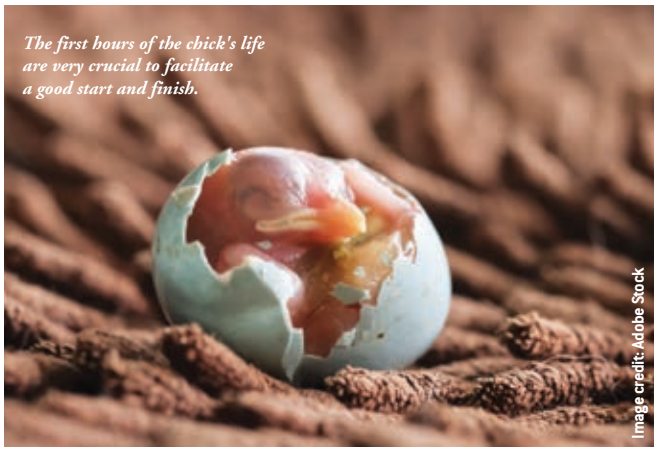
The microclimate of the chicks

The environment of the newly hatched chick must be cosy, warm and clean. It should be provided detailed attention 24 hours a day.

Equipment density: Before the chicks arrive, the farm supervisor must ensure that the brooding area is completely ready and adequate for the number of chicks arriving. This includes having adequate floor space, feeder, space, drinker space, high quality and fresh litter material in the brooding area, etc.

Litter quality: Litter that is old, caked, wet or dusty must be replaced with high quality, fresh litter. In areas where litter cannot be changed after each broiler cycle due to costs for new litter, availability of new litter, or difficulty in disposing of used litter, the litter should be changed only where the chicks are to be brooded the first week, and other areas where litter is caked.

Chicks can lose much of their core temperature through the skin of their legs in contact with the litter. Thus, bedding that has not been properly warmed before the chicks are placed can dramatically reduce chick survival. In places where there are cold temperatures, it is recommended to warm up the brooding area for at least 24 hours before the chicks arrive to ensure litter temperatures have warmed. ■



The first hours of the chick's life are very crucial to facilitate a good start and finish.

Image credit: Adobe Stock

- Evaluate temperatures throughout the brooding area with a digital thermometer
- Determine temperatures on litter surface and approximately two cm above the litter
- Monitor their behaviour and spread pattern to determine if the temperature and ventilation are suitable. Close observation can determine if problems exist, and farm managers need to understand the behaviour of happy chicks versus stressed chicks.

Asia-Pacific dominates global aquafeed market

As fish is a low-cost and most easily digestible animal protein, the rise in fish farming activities and aquaculture has led to increased demand for fish feed.

THE DEMAND FOR cost-effective and high-quality aquafeeds makes it clear that producing the best feed requires specialised feed processing technologies.

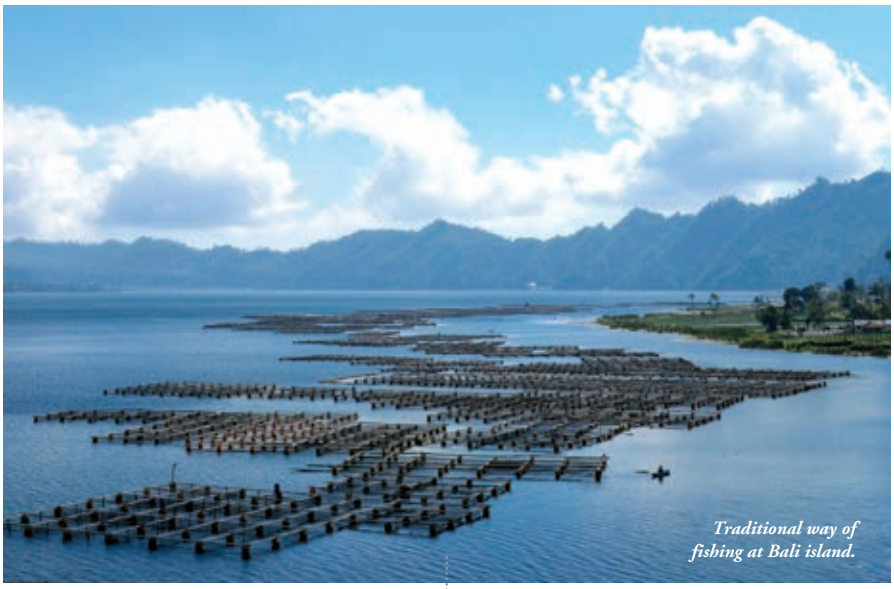
The global aquafeed market was valued at US$110.52bn in 2018 and is expected to reach US$230.12bn by 2026 at a CAGR of 9.6 per cent during the forecast period, according to Maximize Market Research, a global market research farm.

The emergence of new species in aquaculture and the growth of fish farming are creating new revenue avenues for the players operating in the market. The new fish species which include meagre, amberjack and wreckfish are more dependent on commercially manufactured compound feeds.

According to the Maximize Market Research, the drive is mainly seen due to the introduction of new algae aquaculture feed ingredient as the replacement for fishmeal and fish oil with plant-based materials, which are low in docosahexaenoic acid (DHA) in formulated feeds.

"More than 70 per cent of fish meal protein is replaced with soybean meal without adding squid meal, krill meal and attractants. Soybean meal increases the proteins in the human body by decreasing the oils that cause health issues. Data collection and dissemination is a major element for monitoring the status and trend of ornamental fish culture," the report stated.

"Demand for salmonid feeds will be almost static with increases in aquaculture production being compensated by improvements in food conversion ratio (FCR). Equally, the market for commercial feeds is expected to increase for catfishes and other carnivorous fishes," the report has further added.



Traditional way of fishing at Bali island.

Image credit: Adobe Stock

Soybean segment set to account for the largest share

Based on the ingredients type, the soybean segment is expected to account for the largest share in the aquafeed market during the forecast period. Soybean is an excellent source of protein for aquafeed, it contains around 48 per cent high-quality protein. It is also rich in digestible amino acids and xanthophylls. Because of its high nutrient level, it is extensively used as an important protein source in the production of aquafeed.

Asia-Pacific dominates the global market share

The Asia-Pacific region dominates the global aquafeed market. The Asia-Pacific is the largest aquafeed market in 2018, accounting for more than 53 per cent of the global market's revenue and constituting more than 58 per cent of the overall aquafeed consumption. The highest growth for fish consumption is expected from the Asia-Pacific and Latin American regions because of changing diet patterns, urbanisation, population and economic growth.

For example, the Chinese demand for fish continues to surpass the domestic supply, as stated by Agriculture and Agri-food Canada. North America and Europe, which have relatively small aquaculture industries, have a high demand for fish and other seafood products and depend on Asian producers to meet their demands.

As noted by the United Nations Food and Agriculture Organization (FAO), the Asia-Pacific region is taking important preparatory steps to strengthen the governance of aquaculture for sustainable development and future food security. Following four decades of advancements, aquaculture has surpassed capture fisheries to become the major source of fish for human consumption in Asia. Total production of aquaculture reached 103 million tonnes in 2017, and that fish supplied around 60 per cent of food fish for human consumption. In 2017, the average per capita fish consumption in Asia reached 24kg, contributing 23 per cent of animal protein in Asian diets.

As fish is the low-cost and most easily digestible animal protein, the rise in fish farming activities and aquaculture has led to increased demand for fish feed. Additionally, the adoption of artificial settings like Recirculating Aquaculture System (RAS) and Aquaponics to increase fish production and its availability for consumption is generating the demand for aquafeed. ■

Autonomous tractor working on the field.

Image credit: Adobe Stock

New vehicles changing the future of farming

With farmers across the globe embracing more smart farming technologies, the agricultural equipment market is radically transforming to improve efficiency and productivity.

WITH EVER-GROWING investments in smart farming and increased use of the Internet of Things (IoT) in agriculture, agricultural equipment is set to witness strong growth in the coming years.

According to Delaware-headquartered market research firm Global Market Insights, agriculture equipment market is expected to exceed US$200bn by 2024. The integration of smart technologies and adoption of IoT technologies provide remote monitoring and control of the several farming processes, allowing the farmers to improve the efficiency and productivity. Moreover, emerging technologies including sensors, drones and unmanned vehicles are revolutionising the agriculture machinery market over the coming years.

Several advantages of these smart solutions include increased production, accurate farm and field evaluation and reduced environmental footprint.

Self-driving tractors

The autonomous tractors market worldwide is projected to grow by 41.8 thousand units, driven by a compounded growth of 23.8 per cent. This is poised to reach more than 18.3 thousand units by the year 2025, showed a study by Research and Markets.

According to the industry leaders, small and self-propelled tractors are the future of farming, as autonomous tractors use advanced sensors and systems, making everyday farming simple and easy for the growers. Important benefits of autonomous tractors include excellent accuracy in automatic planting system; exceptional seed conservation ration; acquiring right information on soil conditions; improved maintenance; reduced workloads and improved return on investment.

> **"The drivers are increased efficiency and farm productivity, increased labour costs and better management of farm activities."**

The drivers identified in the market are increased efficiency and farm productivity, increased labour costs and better management of farm activities. Farmers are increasingly adopting agricultural mechanisation as a substitute to manual labour with a more cost-effective, easily available and more efficient means of agricultural operation. They are shifting towards autonomous tractors to save time and resources which in turn is increasing the farm productivity and per acre yield of crops.

As the world's second largest economy and the new game-changer in global markets, China exhibits the potential to grow at 22.6 per cent over the next couple of years and add approximately 6.9 thousand units in terms of addressable opportunity for the picking by aspiring businesses, according to the Research and Markets.

Telehandlers

The agricultural telehandlers facilitate transport, lifting and positioning of the light and heavy loads. Equipped with a telescopic boom that can lift loads, mounted on a four-wheel-drive chassis, telehandlers can reach greater heights and distances, thus making it a unique and much-used vehicle for a wide range of farm management practices.

The agricultural telehandlers are suitable for several field applications such as handling large quantities of crops and transport and storing them in silos. As telehandlers are capable of providing multipurpose solutions, they are a perfect choice to save time, money and effort of the growers, increasing production time, efficiency and profitability.

All-terrain vehicles (ATVs)

ATVs are widely used to allow farmers to easily travel across many acres of the land and perform a wide range of jobs. A major advantage offered by the ATVs is its capacity to transport supplies across the farm. ATVs are widely used to simplify all kinds of transportation tasks of the farmers.

Other uses of ATVs include ploughing fields to prepare them for crop plantation; raking tree debris, leaves, brushes etc; harrowing fields to sorting the soil and breaking clumps; mowing grass; building fences; distributing seeds across the fields; carrying firewood and others. ■

PIG BUYERS'GUIDE

2019

Section One – Supplier listings by categories
Section Two – List of suppliers
Section Three – Contact details of agents in Asia

PLEASE MENTION FAR EASTERN AGRICULTURE WHEN CONTACTING YOUR SUPPLIERS

Section 01

All Equipment
Henke-Sass, Wolf GmbH
Hotraco Agri b.v

Artificial Insemination Equipment
Landata Cobiporc

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Hermitage Genetics

Disinfection Products
Eurofeed Technologies S.p.A.
Evans Vanodine
Goizper Group - Goizper Spraying Business
Intraco Ltd. n.v

Environmental Control
Big Dutchman International GmbH
Goizper Group - Goizper Spraying Business
Hotraco Agri b.v
LUBING Maschinenfabrik GmbH & Co. KG
Termotecnica Pericoli S.r.l.

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Myanmar to witness field demonstrations of agricultural machinery from 29-30 November

AGRITECHNICA ASIA LIVE will be held from 29-30 November in Naypyitaw, Myanmar, providing a platform to foster sustainable agricultural mechanisation by demonstrating the use of up-to-date technologies in the regional cropping systems.

The event will be hosted by the Agricultural Mechanisation Department of the Ministry of Agriculture, Livestock and Irrigation. Partners include the International Rice Research Institute (IRRI), Myanmar Rice Federation and the World Bank.

Contributing to 17.6 per cent of the country's GDP and 60 per cent of the labour force, agriculture is the backbone of Myanmar's economy. Due to the thriving machine rental market, falling equipment prices and better financing options, sales in almost all categories of agricultural machinery has increased during the last years.

Commenting on the importance of mechanised farming practices to boost Myanmar's economy, Martin Gummert, senior scientist, leader mechanisation and postharvest cluster, IRRI, said, "The Agritechnica Asia Live is going to provide the opportunity for producers, processors, machinery contract service providers and value chain actors to learn about state of the art machinery and postharvest equipment that will make agricultural production more efficient, reduce cost, provide value-adding opportunities and lead to a more sustainable production systems while at the same time providing incentives for young people to stay engaged in agriculture as a career choice."

Image credit: Agritechnica Asia

Exhibitors profile will include tractors, soil preparation, drilling and sowing, smart plant protection, precision fertiliser applications, irrigation and others.

Organised by VNU Exhibitions Asia Pacific and DLG International, Agritechnica Asia Live will be presenting field demonstrations of agricultural machinery. Important agenda include:

- Live machinery demonstrations of different field operations for more than 1,000 progressive farmers and machinery operators from Myanmar
- Seminars with machinery operators, dealers, agricultural expert organisations and government representatives
- Several networking sessions on both days

Exhibitors profile include tractors, soil preparation, drilling and sowing, smart plant protection, precision fertiliser applications, irrigation, harvesting, logistics, grain processing and storage.

Developing new opportunities in Myanmar's livestock sector

MYANMAR'S LEADING INTERNATIONAL livestock, feed and agriculture industry exhibition Agrilivestock Myanmar 2019 will be held at the Myanmar Expo Hall in Yangon from 5-7 December.

Organised by AMB Tarsus Events Group, Agrilivestock Myanmar 2019 will feature the latest products covering livestock breeding equipment, feed supply and machines, animal health products and many other categories.

Image credit: AMB Tarsus Events Group

A variety of the latest products and solutions will be showcased.

The expo is set to serve as Myanmar's premier international B2B platform for showcasing a variety of the latest products and solutions for improving the local livestock sector. With a target to attract around 6,018 visitors and 128 exhibiting companies from 23 countries, the expo is expected to provide an opportunity for overseas companies to meet, network and form mutually beneficial relationships with local industry professionals and major decision-makers.

Balancing environmental and financial concerns

Held in conjunction with the expo will be the Agrilivestock Conference 2019, a forum for discussing the issues in Myanmar's livestock industry as well as proposing ideas to overcome these issues. Many prominent guests from Myanmar's major public and private institutions will be attending the conference, which will feature presentations by important international speakers from some of the world's leading organisations in the livestock sector.

Main industries to participate include agricultural processing; wood and wood products; copper, tin, tungsten, iron; cement, construction materials; pharmaceuticals; fertiliser; petroleum and others.

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Origin of deadly wheat pathogen discovered by the researchers

The discovery opens way to identifying genes to create rust resistant wheat crops.

THE ORIGIN OF a deadly wheat pathogen which threatens a vital global food source has been identified by an international team of academic researchers including two professors from the University of the Free State in South Africa.

First identified in Africa two decades ago, the strain of the stem rust fungus, 'Ug99,' was said to threaten the global wheat supply due to its ability to attack most varieties planted across the world. Rust diseases cause substantial crop losses each year. It was first detected in Uganda in 1998 and described in 1999 and has since given rise to an asexual lineage that has spread through Africa to the Middle East causing devastating damage to wheat crops.

Professor Zakkie Pretorius and Professor Botma Visser, researchers from the Department of Plant Sciences, University of the Free State in South Africa, joined forces with the University of Minnesota; the Commonwealth Scientific and Industrial Research Organization (CSIRO); and Australian National University, to uncover the basis of the stem rust fungus strain Ug99's virulence by examining the pathogen's genome.

They determined that the pathogen can be traced to a rarely observed phenomenon where two different rust strains fuse together and exchange intact nuclei. This is said to create a hybrid strain with a wider host range than its original parents.

"Ug99 is an imminent threat to global food security due to its wide virulence and potential ability to spread across continents and oceans to infect distant wheat crops," said Professor Zakkie Pretorius of the University of the Free State.

Dr Melania Figueroa, from the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia, added, "This information will be critical for deciphering the genetic basis and evolution of rust virulence on wheat and for monitoring the global movements of the pathogen."

> **"Ug99 is an imminent threat to global food security due to its wide virulence and ability to spread across continents."**

Why is this discovery important?

Dr Figueroa commented, "The more you know your enemy, the more equipped you are to fight against it. Knowing how these pathogens came about means we can better predict how they are likely to change in the future. This discovery also means that we can better identify the resistance genes, which can be bred into wheat varieties to give crops long-lasting protection against rust."

Dr Feng Li from the University of Minnesota and joint first author on the study said, "As plant scientists, we are always looking for an advantage over stem rust in order to develop more durably resistant crops. The data obtained from this study will provide us with new insights on how Ug99 emerged to threaten wheat across the world." ■

The pathogen is a threat to the gobal wheat supply.

Image credit: Adobe Stock

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