

Think Zinc!

The 4th International Zinc Symposium demonstrated how the links between agricultural usage of zinc fertilizers and human nutrition and health are becoming stronger. However, more efforts should be made to insure that this linkage becomes even stronger in the future. The only sustainable solution to zinc deficiency in humans globally has to come from the agriculture sector. It is a "win-win" scenario – better crop production and better nutritional health, highlighted by Prof Ross Welch from Cornell University, USA. According to Prof Welch, zinc deficiency in humans has its origins in the zinc status of agricultural soils and correcting the root cause of the problem, therefore, entails the use of agricultural tools.

The conclusions of the meeting are summarized for New Ag International readers by Dr Ismail Cakmak, Sabanci University, Turkey in collaboration with the session chairs Ross Welch from Cornell University, USA, Martin Broadley from Nottingham University, UK, Ellis Hoffland from Wageningen University, Netherlands and Milton Moraes from Federal University of Parana, Brazil



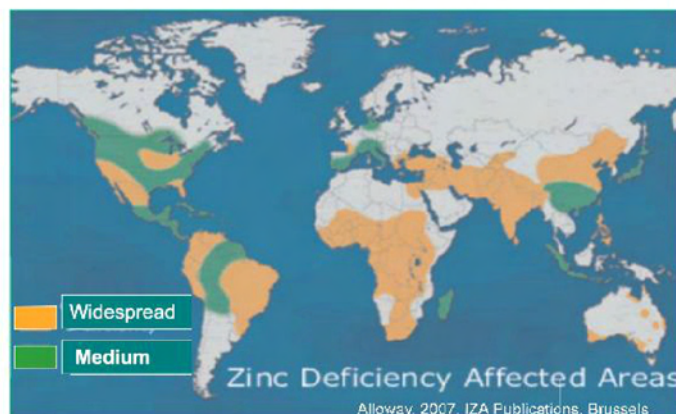
The 4th International Zinc Symposium has been held in Sao Paulo, Brazil, from 15 to 17 October 2015. Total number of the registered participants was 160 from 38 countries. The Symposium was an international scientific conference to review the latest knowledge and best agricultural practices in addressing zinc deficiency and its impact on global crop production and human health. The event was organized jointly by the International Zinc Association (IZA), the International Fertilizer Industry Association

(IFA) in collaboration with the HarvestPlus Program.

ZINC DEFICIENCY IN HUMAN NUTRITION: A SOCIAL AND ECONOMIC PROBLEM

Maria Elena Ugaz from UNICEF was one of the keynote speakers of the symposium. She presented a summary of the efforts of UNICEF and the International Zinc Association to reduce childhood chronic malnutrition in Peru focusing on micronutrient deficiencies (e.g., zinc, iron, vitamin A and folic acid) and diarrheal diseases. Two interventions were

used: multiple micronutrient supplements (MMS) and supplemental Zn for treating diarrheal diseases. All children in Peru from 2 to 36 months old now have access to MMS. Access to Zn supplement treatment of diarrheal diseases has greatly increased in some regions of Peru. The percentage of children less than 3 years of age with diarrheal diseases has decreased after treatment with Zn supplements. Episodes of bloody diarrhea were also reduced in some regions of Peru. Indigenous people in some



regions now have access to Zn treatments for diarrheal diseases. These activities from 2010-2014 have resulted in reductions in chronic malnutrition in children in Peru from 23.2 % to 14.6 % (an 8.6 % reduction).

Marilia Nutti, working in EMBRAPA in Brazil, presented information on biofortification activities (i.e., Biofort) in Latin America and the Caribbean. In 2012, AgroSalud, a program to develop biofortified crops for Latin America and the Caribbean Countries (LAC) was integrated into the global HarvestPlus program. She described past and current nutritional and economic impacts of putting biofortified crops, enriched in iron, zinc and provitamin A, in farmers' hands. A food basket approach including pumpkin, rice, sweet potato, beans, cowpea, maize and wheat, has been used by Biofort. She described progress and future biofortification plans for Brazil, Guatemala, Nicaragua, Panama, Haiti and Bolivia.

Andrew Green, from the International Zinc Association (IZA) in collaboration with the Clinton Health Access Initiative (CHAI) presented information about increasing the use of zinc and oral rehydration salts (ORS) in Uttar Pradesh, India. Diarrhea is the second leading cause of death in children in India. In 2004, the World Health Organization recommended the use of zinc and ORS for children up to



Opening session (from left to right) Wolfgang Pefeiffer (HarvestPlus), Patrick Heffer (IFA), Ismail Cakmak (Sabanci University), Alfredo Scheid Lopes (Lawras University) and Andrew Green (IZA).

five years of age to treat diarrheal diseases and resulting dehydration. Zinc was shown to decrease the duration and recurrence of diarrheal diseases. The CHAI program has generated significant increases in sales and distribution of ORS and zinc supplements. Soumitra Das from India presented information on zinc nutrition in the soil-plant-animal-human continuum for sustaining food and nutritional security in India. Fifteen Indian states were studied for zinc adequacy of soils. 43% of the soils in these states were shown to be zinc deficient while 15% were prone to zinc deficiency if not properly managed. Combinations of both soil applications and three foliar sprays using zinc fertilizers were shown to be the best way to enhance zinc in edible portions of rice, wheat and pigeon pea.

Manfred Zeller from the United States of America presented findings on the economic and social issues of zinc deficiency. He highlighted long-term substantial economic and social impact of biofortification for human populations living in South Asia, to be achieved with adoption, production and consumption of biofortified high zinc rice and high zinc wheat in India and high zinc wheat in Pakistan and high zinc rice in Bangladesh over the next three decades. Martin Broadley from the United Kingdom presented a talk on valuing zinc fertilizer use in Pakistan. Zinc fertilizers are underutilized globally. Greater than 80% of the rice-wheat production areas in Punjab Province, Pakistan are zinc deficient because of little awareness among farmers and low availability of zinc fertilizers. Using 5 kg ha⁻¹ of zinc per ha can increase rice and wheat yields by greater than 10% resulting in a 7:1 value:cost ratio. Using zinc fertilizers can increase zinc in crops and lower zinc deficiency risk in

human populations. In Pakistan, zinc fertilizer use is very low being less than 10% of the potential demand. Wheat grain-zinc concentrations average about 24.9 mg Kg⁻¹ in Pakistan and dietary zinc deficiency risk is about 15% of the Pakistani population. This amounts to about 27 million people at risk of developing zinc deficiency. Ming Xian Fan from China presented information about the Zinc Nutrient Initiative's (ZNI): promotion of zinc fertilizer in agriculture for increased food security, nutrition security and economic benefits. The International Zinc Association (IZA) established the ZNI in 2009 in China and India. The ZNI has expanded to include Brazil, Bangladesh, Thailand, Malawi and Peru. The IZA predicts that the zinc fertilizer market will double by 2016. The potential market is 585,000 tonnes as nations include zinc in their balanced fertilization practices to increase food production and to address the zinc-nutritional value of crops and improve



All pictures courtesy of Harvest Plus/Ismail Cakmak

economic outcomes for farmers in developing nations. Samuel Clemens, from Ethiopia, reported on the potential linkages between zinc in soils and human nutrition in Ethiopia. The prevalence of stunting in children in Ethiopia is an important problem and related to inadequate zinc intakes from their diets. Over 95% of children in some regions of Ethiopia have inadequate zinc intakes. A program has been developed to study soil maps and food consumption surveys to examine location and extent of soil-zinc deficiency and corresponding zinc status of the people in Ethiopia.

PLANT PHYSIOLOGY, GENETICS, AND MOLECULAR BIOLOGY: THE TOOLS TO BETTER UNDERSTAND ZINC IN SOILS AND PLANTS

Michael McLaughlin, 2015 IFA Norman Borlaug award winner, from CSIRO and Adelaide University in Australia opened the session with a wide-ranging keynote presentation on progress in Zn research since the 1993 meeting on Zn in soils and plants. He said that he thought that perhaps more progress had been made in plant science compared to soil science. An interesting development flagged was the use of high-resolution ICP-MS analysis of native stable Zn isotopes in soil-plant systems. This is giving integrated new insights into soil and plant processes, and along with use of enriched stable isotopes, is likely to be used more widely in the future.

Stephan Clemens, from Bayreuth University in Germany, described progress made in understanding molecular aspects of an extreme Zn accumulator plant, *Arabidopsis halleri*, from the mustard family. This plant can accumulate astonishing amounts of Zn in its leaves (5% DW), which is 3 orders of magnitude more than most plants. The use of mutants has shown that cation pumps (e.g. HMA), nicotianamine biosynthesis proteins are key aspects involved in xylem loading of Zn, where malate becomes an important factor in shoot

translocation. One interesting statement made by Stephan Clemens was as following: can we use hyperaccumulators as salads? Mark Aarts, from Wageningen University, followed this talk with a talk on a related hyperaccumulator species, *Nocca caerulea*. He showed that the macro-structure of the genome is similar to another extremophile Brassicaceae, the salt-tolerant *Eutrema*. There is evidence of recent duplications in the genome, which has also occurred independently in *Arabidopsis halleri*. The role of lignin in hyperaccumulation was highlighted. Daniel Persson, from Copenhagen, presented exciting new high-resolution imaging and compositional analysis data, showing how Zn is distributed within the wheat grain, including where it does – and does not – collocate with phosphorus and sulfur. These approaches are likely to enable rapid progress in understanding the mechanisms of grain loading of Zn and other elements in coming years.

Wolfgang Pfeiffer, from HarvestPlus presented an overview of the major progress made by HarvestPlus in deploying biofortified crops/products. Notably, there is increased adoption of high-Zn material, including wheat in India and Pakistan, and maize in Zambia. A notable highlight was how HarvestPlus is interacting with many stakeholders in different countries to ensure that the message reaches smallholder farmers, with a great example of a TV commercial from Rwanda highlighting the benefits of high-Fe beans. Velu Govinda, from CIMMYT in Mexico, presented the genetic story behind breeding for high-Zn wheat. Thus, diverse germplasm was screened, selected and crossed into adapted material, and subsequently released as W501 and W601 in India, and N421 in Pakistan (this year). It is likely that wild relatives of wheat hold even more genetic potential for increased grain Zn concentration.

Mallikarjuna Swamy, from IRRI in Philippines, moved the session into

the area of rice breeding. A combination of QTL and genome-wide associative mapping are among the tools being used by the Philrice team and colleagues in Bangladesh. Promising varieties developed have been shown to



“The role of fertilizer strategy in alleviation of zinc deficiency in human populations is very important”

Prof Dr Ross Welch,
Cornell University (USA)

contain 20 and 25 ppm Zn in Philippines and Bangladesh, respectively, which are much greater when compared to standard lines. James Stangoulis, from Flinders University in Australia, described new experimental work on the HvSUT-1 over-expressing wheat line. Imaging shows accumulation of Zn in the endosperm where it does not collocate with P/phytate. Consistent with this, bioavailability studies show that the Zn is bioaccessible. Valeria Ochoa, from Wageningen University, presented an elegant genome-wide associative mapping project in the model plant, *Arabidopsis thaliana*. Plants (~350 different populations) were grown with and without adequate Zn supply. A small target region rich in metal-binding proteins, including specific SNP-variants, are now being studied using functional genomic approaches.

Anika Mrozek-Niecko, from ADOB in Poland, described a very clear set of agronomic experiments on

wheat, conducted in collaboration with Sabanci University. These were designed to identify optimal forms and timings of foliar Zn fertilisers. The optimal form (ZnDHA), applied with the right surfactant and at the optimal time/humidity, led to 200-400% increases in grain Zn concentration. Levent Ozturk, from Sabanci University, brought the session to a close with a fascinating series of physiological studies, using radiolabelled Zn, which showed that adequate Mg nutrition is essential for phloem-loading of Zn.

CROP BIOFORTIFICATION WITH ZINC FERTILIZERS: SUCCESS CONFIRMED!

This was a very diverse session, addressing the whole chain from soil to human health. It started with an excellent keynote by Rainer Schulin from ETH-Zurich. He showed that the application of crop residues increased soil organic matter content, DTPA-extractable soil Zn, available soil phosphorus, yield and grain Zn concentration in two wheat cultivars. Legume residues had a stronger effect on yield than residues of other crops, because they also supplied the wheat with nitrogen. He concluded that organic matter management can be a feasible approach to agronomic Zn biofortification of wheat that should be particularly attractive for farmers in semi-arid to arid regions, where soils are often not only rich in carbonates but also low in organic matter. The second keynote was by Fien Degryse from the University of Adelaide. She made the audience aware of the fact that zinc from fertilizers (powders or granules, mixed or banded) may precipitate with, for instance, phosphate, depending on the form in which it is applied. She explained with great visualizations how diffusion of Zn away from where it is applied towards the plant root, is of essential importance to the fertilizer’s final effect. The interaction between soil, fertilizer compound and application method finally determines this process, and

should be taken into account. In his oral presentation Philip White from the James Hutton Institute, Scotland, reported on a project to mitigate zinc deficiency in the Scottish population through biofortification. Foliar application of zinc resulted in a threefold increase in potato zinc after processing of the potatoes. This could increase significantly Zn intake of human populations in Scotland. Susan John from India reported on an impressive amount of experiments on zinc application to cassava in India. Application of 2.5 kg ha⁻¹ Zn appeared to be sufficient to prevent depletion of the soil and to sustain yields. Li Meng from China showed that foliar application of Zn alone could increase soluble Zn in wheat flour. In combination with nitrogen, it also increased the flour's content of essential amino acids.

Abdul Rashid from Pakistan reported on multiple field experiments with soil and/or foliar application of zinc to wheat. Treatments with foliar application were most effective in enhancing grain Zn content. Also priming of seeds with Zn resulted in a remarkable increase in grain Zn. Peter Kromann from Ecuador presented the efforts that International Potato Center (CIP) undertakes to biofortify Andean potato with zinc and iron. Field experiments with Zn fertilizer were highly effective, and showed variation among cultivars for response to Zn fertilization. For iron, the results were less promising. Ivan Ortiz-Monasterio from CIMMYT in Mexico showed convincingly that addition of zinc to pesticides does not compromise the effect of the pesticides on wheat. He also showed effects of timing: the effect was largest when applied around heading time.

**ZINC DEFICIENCY IN SOILS:
30 MILLION HA IN BRAZIL ALONE!**

Luiz R.G. Guilherme, from Federal University of Lavras, Brazil showed cases of evidences of zinc deficiency in the Brazilian population. First, he presented statistics of the progress

made in Brazilian agriculture as important world food producer. The mentioned progress in productivity is closely related to adoption of the micronutrient fertilizers. Several examples of studies were presented



"Zinc fertilizers are underutilized globally. Greater than 80% of the rice-wheat production areas in Punjab Province, Pakistan are zinc deficient because of little awareness among farmers and low availability of zinc fertilizers"

Prof Dr Martin Broadley,
Nottingham University (UK)

demonstrating the positive response of crops to Zn fertilization. He finished his presentation showing a map for zinc in soils of Brazil. It seems that there are still about 30 million hectare arable land with zinc deficiency.

Erik Smolders, from Leuven University, Belgium, presented the limits for Zn in the environment. Geological background values range from 5 to 150 mg Zn/kg, with global estimated means about 50 mg Zn/kg. Zinc toxicity may occur in plants, depending on many factors. Clear examples of Zn toxicity in the environment can be found around Zn-smelters. High Zn may act antagonistically for uptake and toxicity of other metals. Sewage sludges represent main carrier of Zn into the environment. Ellis Hoffland, from Wageningen University, presented a talk with regard the availability of soil Zn to

plants. She focused on the soil factors affecting Zn nutrition in plants, e.g. organic matter, pH, etc. In order to predict Zn bioavailability and plant uptake, a mechanistic understanding of the distribution of Zn fractions (e.g., soluble Zn vs fixed Zn) in rhizosphere is essential which is under direct influence of various biological and chemical processes in soils. She highlighted that rhizosphere pH and root exudates largely affect changes in Zn fractions in rhizosphere soil and root Zn uptake.

Yashbir Shivay, from India, moved the session into the area of zinc fertilizer management to enhance the yield and Zn use efficiency. He emphasized existence of close relationship between zinc deficiency in human beings and nutritional quality of food crops in terms of zinc concentration in India. Foliar application of Zn fertilizers has been shown as the best treatment to increase grain Zn concentration in rice. Muneta Manzeke, from

Zimbabwe, presented interesting results of zinc management strategies targeting to increase cowpea productivity and Zn biofortification in cowpea grown in Zimbabwe. The results obtained showed that using cattle manure plus NPK+Zn improved grain Zn and productivity. There was a close relationship between soil Zn vs grain Zn concentration. Estêvão Mellis, from Agronomic Institute of Campinas - Brazil, gave the last talk of Zn Symposium by presenting the results of zinc fertilizer management on the yield and quality of sugarcane. He underlined the lack for field experiments with zinc and other micronutrients in sugarcane in Brazil. Field tests showed that sugarcane responded very positively to Zn fertilization in several regions. The organizing committee of the 4th International Zinc Symposium is planning to organize the next (5th) International Zinc Symposium either in Europe (probably in Spain) or in Asia (probably in China) in 2018. ■

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The results obtained under the HarvestZinc Project of the International HarvestPlus Consortium revealed the feasibility of the fertilizer strategy and its vast potential in contributing to human zinc nutrition. In view of the promising results gathered during this second phase, it was decided to continue this highly promising zinc fertilizer project (by including also iodine) again, due to its great potential to create large short and longer term practical impacts and to improve human nutrition with zinc and iodine. One of the important components of the new phase of the project is to exploit the synergy between genetic and fertilizer strategy in enrichment of food crops with zinc and iodine. The 3rd phase of the project that is developed under the HarvestPlus program is supported by SQM-Chile; Bayer CropScience-Germany; ADOB-Poland; K+S Kali-Germany; IFA-France; Valagro-Italy; ATP Nutrition-Canada; ICL-Israel; Mosaic-USA; Aglukon-Germany; IZA-Belgium and IPNI-USA. Prof Cakmak, who leads the project, has the story.

The HarvestZinc Project:

New Concepts for the third phase

During Phase II of the HarvestZinc project, field experiments focused on the "mega-crops" wheat and rice and included sorghum and common bean. Wheat experiments were conducted in Turkey, China, India, Pakistan and Zambia; rice experi-

ments in China, Thailand and India; common bean studies in Brazil, and sorghum experiments in Zambia. There were major results and accomplishments in the 2nd Phase of the HarvestZinc Project.

GRAIN YIELD AND GRAIN ZINC CONCENTRATIONS

Field experiments revealed a large variation for grain yield response to Zn fertilization among countries and their locations for wheat, rice, sorghum and common bean. For wheat, combining data across the major wheat-growing countries India, Pakistan, China and Turkey and cropping years, soil Zn application and using Zn-enriched seeds improved wheat grain yield in 19 locations by 7.6% and 4.8%, respectively. For rice, analyses across 14 Asian locations in India, China and Thailand revealed increases in grain yield by 6.2% and 4.0% for soil Zn application and Zn-enriched seeds, respectively.

Grain Zn concentrations were strongly increased by foliar Zn applications, while soil Zn application was less effective. Foliar Zn

application in the form of ZnSO₄ increased grain Zn significantly: a single spray of ZnSO₄ resulted in a net increase of 7 ppm in grain Zn of wheat. The net increase in grain Zn reached up to 13ppm (i.e., 42% increases) by applying certain commercial foliar Zn fertilizers from different companies. Besides EPSO TOP-Zn, several other foliar Zn fertilizers/compounds with higher impact on grain Zn were identified within the HarvestZinc project such as Antracol (a Zn-containing fungicide) from Bayer CropScience, Brexil-Zn from Valagro, EPSO-Zn from Kali K+S, Omex-II-Zn from Omex, Releaf Harvest-Zn from ATP Nutrition and ZnIDHA from ADOB. In the case of spraying of foliar Zn fertilizers twice, increases in grain Zn reached up to 100% in wheat. Timing of foliar Zn application is critical in achieving desired increases in grain Zn. Foliar spray of Zn late in the growing season in wheat (e.g. after flowering time) caused much greater increases in grain-Zn when compared to the foliar application of Zn at earlier growth stages. Rice showed less response



to foliar Zn fertilization when compared to wheat.

POSITIVE IMPACT OF HIGH SEED-ZINC ON SEEDLING GROWTH

The effect of Zn-enriched seeds on seedling development and stand establishment was evaluated by measuring the number of emerged plants and seedling height during early growth stage. Using seeds enriched with Zn through foliar fertilization in the previous year had very positive effects on germination and seedling development of wheat. Increases in seedling development translated into higher grain yields.

NO PROBLEM MIXING ZINC FERTILIZERS WITH PESTICIDES

The 2nd phase of the project has also studied whether the use of ZnSO4 together with widely used fungicides and insecticides negatively impacts on the agronomic effectiveness of foliar Zn application. The results showed that ZnSO4 can be mixed with the insecticides and

fungicides and sprayed to foliar without any significant antagonistic effect on grain Zn.

Delivery and implementation of the project results to farmers is critical for the success of this project. Hence, the HarvestZinc project has started organizing "Zinc Days" events in the target countries for farmers, agronomists/crop consultants, nutritionists and decision makers. The "Zinc Days" event is organized jointly with the partner countries/institutions to deliver project results to end-users. Within the second phase of the project, a total of 15 "Zinc Days" events were organized in China, Pakistan, India, Thailand, Turkey, Zambia, Brazil and Mexico, and more than 7,000 farmers and agronomists participated in these events.

HarvestZinc project in its 2nd Phase was supported by Mosaic Company, USA; K+S KALI GmbH, Germany; International Zinc Association, Belgium; OMEX Agrifluids, England; International Fertilizer Industry

Association, France; International Plant Nutrition Institute, USA; Bayer CropScience, Germany; ADOB, Poland; Valagro, Italy; FBSciences, USA and ATP Nutrition, Canada.

IODINE AND NEW CONCEPTS ADDED FOR THE THIRD PHASE OF THE PROJECT

As evident from the reports and published results, the project had accomplished its objectives and produced novel results and insights of practical relevance and importance under its 2nd phase. The results reveal the feasibility of the fertilizer strategy and its vast potential in alleviating Zn deficiency in human populations. Hence, it was decided to continue this highly promising fertilizer project by adding also iodine, due to its great potential to create large short and longer term practical impacts and contribute to and complement the "biofortification concept" in the target countries.

The research and implementation program of the 3rd Phase of the

HarvestZinc project, started in 2015, is realized in China, India, Thailand, Pakistan, Brazil and Turkey. Target crops for enrichment with zinc and iodine are wheat in Pakistan, India, China, and Turkey and rice in China, India, Thailand and Brazil. Additional experiments will also be conducted in Mexico by focusing on iodine. One of the important components of the project is to exploit the synergy between genetic and fertilizer strategy in enrichment of food crops with Zn and iodine.

There are 5 major tasks of the new phase of the project which are outlined and introduced below:

TASK-1 is to determine the response of new high zinc crops to soil and foliar fertilizers: Exploiting synergies from genetic and agronomic options: After a long-term successful breeding effort, the HarvestPlus initiated the delivery of the first biofortified zinc-rice and zinc-wheat lines having up to 8ppm (rice) to 12ppm (wheat) added zinc in the



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grain. It is assumed that these bio-fortified genotypes have high genetic capacity to absorb more Zn (and possibly also other micronutrients such as iodine) from the soil and/or transport more Zn from vegetative tissues into seeds compared to currently available cultivars. In its new phase, the HarvestZinc project examines the response of these genotypes to soil- and foliar-applied micronutrient containing fertilizers to capitalize on synergies from agronomic and genetic options.

TASK-2 is to test next generation micronutrient fertilizers: In recent years, several fertilizer companies increasingly pay attention to the impact of their micronutrient containing fertilizers on improving the nutritional quality of the edible parts of food crops. In the past, the focus was mainly on yield. By now, next generation fertilizer products for soil and foliar application have been developed and made available for research and test marketing. Studying these new products for their agronomic effectiveness in

increasing grain Zn as well as grain iodine (see below) constitutes a new task in the 3rd phase of the project. **TASK-3 is to add Iodine as new target micronutrients to the fertilizer strategy in improving human health:** Besides Zn deficiency, iodine deficiency (ID) is also widespread in human populations and negatively impacts on health in particular in children and pregnant women. Main effects include impaired growth and mental development, rapid growth of goiter and increases in pregnancy loss. Despite significant achievements in reducing ID incidence in human populations through the use of iodized salt, there are, however, still approximately 2 billion people suffering from ID. Due to infrastructural and/or cultural problems, the impact of salt iodization interventions on reducing ID has failed in many places. The global efforts to reduce the daily salt intake also raise concerns for further increases in ID in human populations. As demonstrated for Zn, agronomic biofortification approach can

be an effective tool in improving iodine content of staple crops and contribute to alleviation of ID deficiency in humans. Under the 3rd phase of the project, several field and greenhouse experiments are conducted to study effect of iodine-containing soil and foliar fertilizers in increasing iodine concentration in wheat and rice in the mentioned target countries.

TASK-4 is to conduct new research to understand the differential response of wheat, maize and rice to foliar zinc fertilization: A large number of previous fertilizer trials of this project conducted under field conditions in different countries revealed that wheat is very responsive to foliar Zn application in terms of increase in grain Zn. Significant increases were also obtained in rice grain Zn with foliar Zn spray, but the magnitude of the increases are lower compared to wheat. In contrast to wheat and rice, the reaction of maize to Zn fertilization was variable and insignificant. This research task will focus on

understanding the reason behind the low response to foliar Zn spray in maize.

TASK-5: Promote and create awareness to facilitate the adoption of the zinc and iodine fertilizer strategy at the farmer and policy maker levels: Delivery and implementation of the project results will continue as an important element of the HarvestZinc project. Organization of the "Zinc Days Events" will be extended by including iodine to introduce and deliver project results and related knowledge to farmers and governmental organizations in each target country. In addition, large-scale farmer-participatory field trials will be established to demonstrate to farmers the benefits of using high Zn-seeds on germination, seedling vigour and final yield. Studies regarding the cost/benefit analysis of agronomic biofortification initiated in the 2nd Phase of the project, and the results obtained will be validated in the 3rd Phase of the project including iodine. ■



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Don Lauweryssen joins Yargus Manufacturing as VP of Business Development

■ Don has over 25 years of experience in the agri-business sector related to sales-marketing, business development, strategic planning, project development as well as commodity handling & logistics. His management experience includes five years of joint venture company leadership related to billion dollar plus capital projects in Egypt and Australia, project team leadership for capital growth projects in the US and Europe and as a senior director within Agrium's corporate development and strategy group. Don holds both a Bachelor Science in Agriculture and a Master of Science in Agricultural Economics from the University of Alberta. Don started his career in Deloitte's management consulting practice and thereafter entered the fertilizer industry with Cominco as a sales supervisor for a network of retail fertilizer dealers in northern Alberta, British Co-



lumbia and Saskatchewan. Don was involved with the establishment of both ASP and Profertil in Argentina followed by a variety of other international and domestic business growth and development assignments for Agrium. At Yargus, Don is responsible for project development and strategic planning for domestic and international projects.

Matthew Foster Joins Aquatrols as Chief Operating Officer

■ Aquatrols Corporation of America ("Aquatrols"), the leading provider of water enhancement and other technologies used to optimize soil-water-plant interactions, is pleased to announce that Matthew Foster joined its management team as Chief Operating Officer. Matt brings with him twenty years of proven product management, sales, and marketing experience in the agricultural and turf industries. He most recently served as Global Director of New Business Development for FMC Corporation's Ag Solutions business, establishing a global business model for new seg-

ments at FMC including micronutrients, bio-solutions, and seed treatments. Aquatrols Chief Executive Officer Tracy Jarman added, "Our business has expanded in recent years beyond the turfgrass and horticultural industries to include agriculture and seed enhancement as significant components. We have identified the need for additional management experience in our organization and we are thrilled to have Matt join our team. His broad experience base in the agriculture and turf industries will help us continue our growth and diversification."

Hilton Salomão, new CEO in Tradecorp do Brasil

■ The agronomist Hilton José Salomão Santos has recently become CEO of Tradecorp Brazil. Graduated at the Federal University of Rio de Janeiro (UFRJ), he has worked for 14 years in the research and business of the foliar fertilizers, bioregulators and biological products. Hilton Salomão has extensive experience in the management and development of agricultural projects in various crops. In the sector, he has also worked in the management of people and as business manager, acting in large part of Brazil, especially in the Northeast, Southeast and South. The new CEO of Tradecorp do Brasil, moreover, is specialized in plant nutrition by the College of Agriculture "Luiz de Queiroz"



(ESALQ/USP) and is Environment Director of the Brazilian Association of Industry of Plant Nutrition (ABISOLO), which brings together most of the companies that operate in the market of the foliar nutrition.

84th IFA Annual Conference 30 May - 1 June 2016, Moscow, Russia



■ The major annual event of the Fertilizer industry travels to Russia this year. The IFA conference is open to members only. To commemorate the International Year of Soils, world renowned soil scientist, Dr. Pedro Sanchez, the 2002 World Food Prize Laureate and Director of Agriculture and Food Security Center at The Earth Institute at Columbia University gave a commemorative

lecture titled Fertilizers and Soil Health - Debunking the Myths, at IFA's 83rd Annual Conference held in Istanbul on 25-27 May last year. For 2016, IFA has not yet announced special guests. As usual however, the IFA award will be remitted. In 2016, it will be awarded to a nominee from an emerging economy. For more information, browse www.fertilizer.org