

ASIAN SEED

THE OFFICIAL PUBLICATION OF THE ASIA & PACIFIC SEED ASSOCIATION



China Seed Trade

Import & export statistics telling of peculiar trends



Biosecurity

Growing emphasis on phytosanitary standards for movement of seed



Women in Seed

The life, vision of Plant pathologist Dr. Marti Pottorff



Seed for Thought

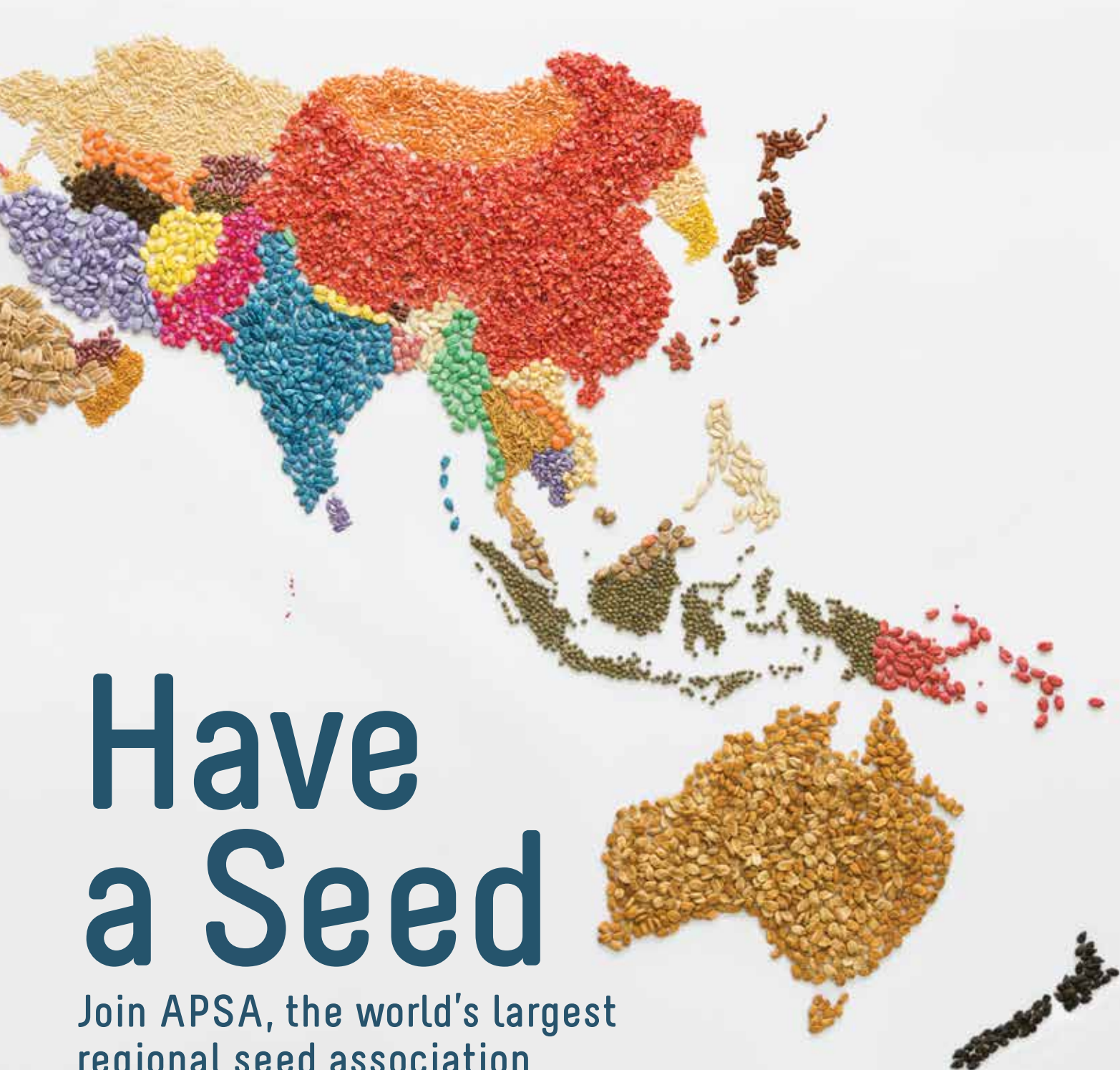
APSA's 2nd president reflects on six decades of industry progress

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In this issue

11 China Seed Trade Trends

Customs data for 2016 seed imports and exports reveal some interesting trends.



22 Phyto-perfect

NPPOs face increasing pressure to mitigate a multitude of biosecurity threats linked to the movement of seed.



26 Women in Seed

Korean-American pathologist making an impact in breeding for resistance against vegetable diseases, shares her wisdom.



32 Seed for Thought

Past APSA president Dr. Kuldip Chopra, an icon in Indian and Asian seed circles, shares his experiences after 60 years in the business.



Is Your Seed Going on a Trip? Make Sure It Has a Passport!



Brenda Dossey, APSA President

The cover theme of this issue of *Asian Seed* is about something that I deal with on almost a daily basis, the phytosanitary certificate. The phytosanitary certificate, or as my bankers call it, the 'plant-health certificate', is an absolute requirement for the international movement of seed. In fact, among your document set or shipping documents, it is one of the few documents that must be presented as an original copy.

I still remember the first phytosanitary certificate I ever obtained. It was 1978 and I had sold some ryegrass seed from Arizona, USA, to a customer in Mexico. The customer had called me on the phone and told me that he needed a phyto. This was before emails, the internet or even faxes, so I had to ask around to find out how to get one. I was told to go to the capitol building in downtown Phoenix, Arizona, and to go to the clerk window. When I walked up, they gave me a small piece of paper to fill out about where the seed was going, what it was called and how much was being shipped. I filled it out by hand and the clerk charged me US\$1.00. She stamped the paper a few times and handed it back to me.

My first phyto! I should have taken a picture of it. But of course, I had no smartphone back then. I didn't even have a non-smartphone. In many ways, it was the Dark Ages of Seed Exportation and International Seed Marketing. We sent letters, and if we were in a hurry, we used a telex or talked on the phone.

Today that story just sounds like a child's fairy tale. Or worse, a plant quarantine nightmare. But it was how it was done back then. The international movement of seed is quite a sophisticated matter now. It is highly regulated and monitored for compliance with matters of biosecurity in the country of origin and destination. Seed exporters and importers need to know the regulations governing the movement of the species of seeds they are working with. These regulations are compiled by the National Plant Protection Organization (NPPO) of the country of destination.

You may need to comply with the conditions of an import permit with special tests for pests and/or diseases, seed treatments (often fumigation and/or fungicide treatments, sometimes insecticide treatment), and possibly even field inspections of the mother crops during active growth before seed

production and harvesting. The conditions for export might be listed in a country export database and may not be part of an import permit. I liken import permits to visas that we would get when visiting certain countries, and, just like visas, import permit conditions are subject to change by the importing NPPO.

At APSA, we view the quest for achieving best practices in the global movement of seed as a priority for our membership. We have an ongoing dialogue between the NPPOs of the Asia-Pacific region on behalf of our members from various governments, national seed associations and seed enterprises. Our phytosanitary expert meetings provide a continued forum for this dialogue. Your APSA membership allows you to be informed of this dialogue and both *Asian Seed* magazine and the APSA website will keep you posted.

Would you like to learn more and become more active in this process? If so, why not consider joining the APSA Standing Committee (SC) on trade and marketing? As an APSA member, you are invited to contact APSA today and learn more about the standing committee's activities and how you can participate in them. 🐣



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Creating Tomorrow Today

Maintaining our Momentum towards the Halfway Mark



Heidi Gallant, APSA Executive Director

I hope this edition of *Asian Seed and Planting Material* finds all our members in good spirits.

I had the very great pleasure of attending the International Union for the Protection of New Varieties of Plants (UPOV) meeting in Geneva back in April. This was a wonderful opportunity to strengthen ties with UPOV as an important global organisation, and to discover changes and improvements to the workings of this influential body that will affect our members in the Asia and Pacific region.

The APSA secretariat is extremely excited to have opened registration for Asian Seed Congress 2017, the Philippines, a month earlier than usual.

Registration is currently open to trading tables and delegates, with booth registration opening up on 1 June. Members are reminded that trading tables sell out very quickly and that Congress Sponsors have first choice of booth space.

Registration is also only open to members at this time. We wish to give our members the enhanced benefit of being able to reserve their space before we open any registration to non-members. If you have yet to log into our membership

database, please be sure to do so as soon as possible. Please be sure to fill out your full profile, including the type of seeds your company works with.

In this edition of *Asian Seed*, we offer an inside look at the World Vegetable Center Consortium Workshop in Taiwan from 10-12 May. The Consortium has received a great deal of interest from members so do make sure to read the full article on pages 8-9.

APSA's Executive Committee met in Bangkok, Thailand, on 16-17 May. We greatly appreciate the time and effort that the volunteers put into preparing and attending this important association meeting. A lot of plans for the rest of 2017 and beyond are being put into place by this body in order to improve our benefits to members and increase the engagement of our members with the association.

From 22-24 May, APSA President Ms. Brenda Dossey and I attended the ISF World Seed Congress in Budapest, Hungary. It gave me a great opportunity to observe how the largest seed association in the world manages their flagship event. Both Secretariats – ISF and APSA – have every intention to increase interactions from and within Asia

to ensure a balanced global input within ISF committees.

Our 11-18 June Study Tour to France received a tremendous amount of interest and we are happy to report that it sold out. All of our Study Tours give participants an exciting opportunity to enhance their knowledge base of seed production. Coverage of the tour will be provided in our next issue of *Asian Seed Magazine*.

June will also see resource personnel from around the world, and National Plant Protection Officers from across the Asia-Pacific region, gather in Bangkok for our 3rd Expert Consultation on Phytosanitary Measures in Asia and the Pacific. These meetings will be held with a focus on collaboration between countries on topics such as phytosanitary requirements and on determinants of how APSA can help these bodies offer clear and concise information regarding regulations for the benefit of our members.

As always the APSA secretariat is here to help you. We welcome any opportunity to hear from our members, so please be sure to email or telephone us with your comments, concerns or suggestions. 🌱



In April, APSA Executive Director Heidi Gallant attended the 53rd Technical Meeting of the International Union for the Protection of New Varieties of Plants (UPOV). The Technical Committee session was part of several meetings in Geneva focused on updates and developments within the organisation's various technical working groups and committees.

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A New Chapter in a Long Relationship

APSA, WorldVeg Vegetable Breeding Consortium Gets Underway with Workshop

The Asia & Pacific Seed Association & World Vegetable Center Vegetable Breeding Consortium held its inaugural workshop on 10-11 May 2017 at WorldVeg headquarters in Shanhua, Chinese Taipei. Thirty-one participants from 20 companies across the region joined 35 WorldVeg staff and two representatives from APSA for discussions, intensive seminars on the Center's breeding work and research, and in-field evaluations of tomato, pepper and cucurbit crops.

"A long relationship built on trust has set a good foundation for this new consortium," said Marco Wopereis, WorldVeg Director General. Although APSA and WorldVeg have met for periodic workshops since the mid-2000s and have conducted some joint research, there has been no formal structure for interaction until now.

The new consortium is designed to provide what its members need most, with participating seed companies getting early access to new breeding lines and the opportunity to interact with WorldVeg experts on upstream research. In return, WorldVeg receives feedback about the performance of its material in various locations and in commercial seed production — vital information that can help the Center demonstrate its value to donors.



Vivian Wang (left) and Susan Li (right) of WorldVeg's Pepper Breeding Unit.

Dr. Wopereis emphasised the importance of the private sector in the vegetable value chain. "Our work has zero purpose if farmers can't get their hands on seed," he said. "Your companies are the essential links."

Heidi Gallant, APSA Executive Director, encouraged APSA members to interact with WorldVeg breeders and use the consortium as

a network to build on advances in vegetable breeding. David Johnson, new WorldVeg Deputy Director General – Research, briefly explained the Center's new flagship research structure, which focuses on discovery research leading to innovations that can be piloted, and then to products that can be scaled. "We need partners like you for piloting and scaling," he said. "That's how we can increase our capacity for science with impact."

Research: Breeding and Plant Protection

Speakers in the first session of the workshop reviewed the Center's research in vegetable breeding and gene discovery. Head of Biotechnology Roland Schaffleitner discussed progress in mapping bacterial wilt resistance genes in tomato. Tomato breeder Peter Hanson updated participants on the

WorldVeg breeding programme for fresh market and dual-purpose (fresh consumption and processing) tomato for the lowland tropics and highland, mid-altitude regions. Interest in processed tomato products is increasing worldwide, he said, but the lack of suitable processing varieties prevents farmers

from exploiting this market opportunity. Pepper breeder Sanjeet Kumar and cucurbit breeder Narinder Dhillon reported on their research activities. APSA members took special note of Bitter Gourd Open Field Days, a two-week field trial for bitter melon held at WorldVeg East and Southeast Asia in Thailand during which companies receive individual attention to address cucurbit breeding questions.

The second session covered plant protection issues. Entomologist Srinivasan Ramasamy discussed the spread of the South American leaf miner (*Tuta absoluta*) and fall armyworm (*Spodoptera frugiperda*), noting the need to understand the taxonomy and bioecology of pests to develop effective management strategies. Breeder Mohamed Rakha updated participants on the Center's breeding work for insect resistance. WorldVeg breeders are aiming to combine insect and disease resistance in tomatoes by using wild relatives with the appropriate traits in their breeding programmes; they recently made an important breakthrough in incorporating insect resistance based on trichomes (plant hairs).

According to David Johnson, the new consortium can be a platform to examine



Dr. Anthony Tse (left) of Clover Seeds and Kazuyuki Tanaka of Takii Seed.



FIELD DAY: Breeding Consortium members Fatkhu Rokhman, Senior Breeding Manager (Cucurbit Group), and Asep Harpenas (in orange), R&D Director (PT East-West Seed), Indonesia, inspect new breeding lines during field demonstrations in Shanhua in May.

larger issues of maintaining resistance — a precious resource that can be lost due to poor agronomic practices, such as many farmers in one area planting monocultures of the same variety. “We need to think about ways to ‘rotate resistance’ across a region,” he said. “The pool of wild relatives with resistance genes is limited. We have to protect the resistance we’ve all spent

so much time and treasure to develop.” All breeders and seed companies must address the challenges of dealing with the rapidly evolving virus landscape, virologist Lawrence Kenyon told the group. Seed health testing was discussed as a possible point for consortium collaboration and training. Yung-kuang Huang and Sophie Chou from the WorldVeg Genebank gave a

quick tutorial on the use of the genebank’s databases and procedures for ordering seed samples. Researcher Willie Chen discussed his studies on salt-tolerant rootstocks for tomato. Although only a few companies in the consortium currently produce rootstock seed, interest in grafting is growing across Asia. 🌱

Performance in the Field

On the second day of the workshop, field tours gave participants a closer look at the performance of WorldVeg breeding material. The tomato team — Peter Hanson, Grace Hsu and Shu-fen Lu — showed preliminary yield trials of bacterial wilt resistant fresh market and dual purpose tomato lines. Pepper experts Sanjeet Kumar and Susan Lin demonstrated the Center’s International Sweet and Chilli Pepper Nurseries. Cucurbit specialists Narinder Dhillon and Vicky Cheng hosted an advanced yield trial of Japanese-style cucumber.

Consortium members welcomed the opportunity to examine the lines and consider how they might be of use in their own breeding programmes. “Although we are all competitors, we’re working on similar things,” said Caleb Orchard, tomato pre-breeder from East-West Seed Co. “Having the chance to meet and talk with breeders from other companies is really useful.”

After the field tours, WorldVeg Nutrition Researcher Andrew Sheu discussed the different ways nutrition messages can be incorporated into companies’ extension services and promotions; David Johnson reviewed issues related to IP rights for WorldVeg genebank accessions and improved lines; Consortium Coordinator Greg Luther stressed the importance of feedback to sustain the consortium; and the group discussed the best methods for collecting and sharing data on WorldVeg germplasm use.

WorldVeg staff then presented concepts for special projects for consortium members to consider and solicited ideas from members about some of their specific needs and concerns.


In closing, Marco Wopereis expressed his delight at the reinvigoration of the Center’s relationship with APSA. “We are all committed to this and there are some big issues that we can work on together,” he said. “Consider us your research organisation.”


The APSA/WorldVeg Vegetable Breeding Consortium is open to APSA members. Please see above to learn more about the benefits the consortium offers and how to register:




For more information about the Consortium, and to join visit apsaseed.org/members-programs/ or scan this QR Code.

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Seeds for a better future...



China Seed Trade Trends

China is an integral player in the seed industry both regionally and indeed globally. As one of APSA's key member countries, the world's most populous country is a lucrative and leading seed production hub and consumer market, where even the most minute deviations in trading activity can have a drastic influence on policies and decisions in every country throughout the Asia Pacific region, without exception.

To better grasp the latest trends in the movement of sowing seed from and to the world's most populous country, *Asian Seed* has compiled, analysed and summarised international trade data from various Chinese sources, including 2016 China Customs Data, the China National Seed Trade Association (CNSTA) and the Business Development Center of the China National Seed Group Co. Ltd., presented herein.

According to available data, last year China exported a total of 34,611 tonnes of sowing seed, worth just under US\$213 million, while importing 52,844 tonnes of seed worth \$288.27 million. Some clear

and peculiar trends stand out in these figures.

Namely, China is making steady progress in becoming more self-sufficient in seed, which is directly related to food security. Although the country had a seed trade deficit of nearly \$76 million last year, having imported 18,233 more tonnes of seed than it exported, the size of the deficit reduced by 36% when compared to 2015 in terms of value and reduced by 56% year-on-year in terms of volume.

Indeed, exports of potato, maize, rice, alfalfa, herbaceous plant and various other types of seed all increased significantly

year-on-year, while imports of nearly every category of seed during the period declined, with the exception being vegetable seeds – of which China had imported slightly more than it did in 2015. See pp.14-15 for specific data.

As is the trend elsewhere in the world, vegetable seeds continue to carry their weight, so to speak, comprising 26% of the total volume of seed exports, yet constituting 53% of the total value, or just under \$113 million. Likewise, of the imports, 9,665 tonnes, or 18.3% of the total volume, were categorised as vegetable seeds valued at more than \$176 million, or 61.2% of the total value.

DISCLAIMER: The data presented herein does not reflect the entire picture of seed trade. APSA cannot verify or endorse the accuracy of the data and will not be held liable for any claims arising from the use of the data, which has been compiled and presented with the aim of highlighting and understanding general trends. Should you note any discrepancies or errors, please notify us.

Imports

In 2016, China imported no less than 52,844 tonnes of seed for sowing, which included vegetable, ornamental, field, forage and fruit seeds and spores. Combined, the imported seeds were valued at nearly US\$288 million, equating to an average price of \$5,455 per t. Of the total volume, about 9,665 t, or 18%, were classified as vegetable seeds, which were worth \$176.5 million at an average price of \$18,269/t, constituting a 61% market share in terms of value.

It should be noted that Chinese Customs' protocol separates data from vegetable and fruit seeds into two categories (namely, category number 12099900 for other "Fruit And Spores", and category number 12099100 for "Vegetable Seeds"). Also, according to Ms. Tian Weihong, Director of the Import & Export Department at the Business Development Center of the China National Seed Group Co. Ltd., tomato seed is classified as a vegetable seed, not as a fruit seed.

Though itemized data was not available for most specific types of vegetable, fruit or ornamental plant seed, figures were available for many types of cash, field and forage crop seed; namely, long-grain paddy (un-milled), potato, maize, alfalfa, sorghum, sugar beet, beet and two different types of rapeseed, classified by their erucic acid content.

Not counting specific types of vegetable fruit or herbacious flowering plants, the most expensive imported seed category that China Customs logged in 2016 was sugar beet, importing a total of 306 tonnes worth \$8.73 million, which equates to an average price of \$28.55/kg. The cheapest imported crop seed was ryegrass, of which



A Chinese seed trader examines Indian rice seed during an APSA Study Tour.

China imported 20,403 tonnes worth \$25.76 million at an average cost of \$1.26/kg.

In terms of gross volume, China's largest supplier of vegetable seeds in 2016 was Italy, from which China imported 5,059.83 tonnes, valued at \$15.57 million, or just over \$3.00/kg. Other top bulk seed suppliers to China were Denmark (1,232.22 tonnes worth \$13.26 million); Thailand (909.56 tonnes worth \$25.52 million); Indonesia (773.43 tonnes worth \$1.33 million); and the US (413.51 tonnes worth \$13.17 million).

The average price China paid per kg of seed varied dramatically amongst supplying countries. Expensive seed came from Kenya (86kg worth \$984,497 or \$11,447/kg); Peru (508kg worth \$2.17 million or \$4,287/kg); India (2.76 tonnes of seed worth \$3.49 million at \$1,263/kg); and Israel (3.8 tonnes worth \$4.7 million or \$1,237/kg). In contrast, cheaper China-destined seeds came from Indonesia, Vietnam, Italy and Hungary,

which on average were worth only \$1.73, \$2.26, \$3.07 and \$7.35 per kg, respectively. Although detailed data on the types and volume of vegetable seeds from specific countries was not readily available, APSA obtained the following leads from industry insiders.

Namely, from Indonesia, China mostly imported water spinach, hot pepper, bitter melon and cucumber, while it imported several hundred tonnes of water spinach seeds from Vietnam.

From Italy, China imported various types of vegetable seeds, including coriander, peas, carrots, white radish, Chinese flowering cabbage, Chinese cabbage, Chinese leeks/chives and celery.

From India, China's main seed imports included sweet corn and hot pepper, while from Peru it sourced tomato, and from Israel, Brassica vegetables (broccoli, cauliflower, cabbage, etc.).

Exports

Last year, China exported 34,611 t of seed for sowing, which had a combined value of \$212.56 million, or about \$6,141/t. Vegetable seeds constituted the largest share in terms of gross value, with 9,176 tonnes worth \$113 million, representing about 53% of the total market at an average price of \$12,334/t, making it the second-highest-value type of exported seed, behind only herbacious flowering plant seeds (\$26,201/t). In terms of gross volume, China exported more long-grain paddy seed than any other type of seed reported, exporting just over 23,000 t, worth about \$74 million, or \$3.23 per kg. The lowest-value type of seed was sorghum, with the country exporting 206 kg of this grain seed worth \$131,442, or \$0.63 per kg.

The top importer of Chinese vegetable seed in terms of gross value was the US, who imported 596 tonnes worth \$33.23 million, or about \$55.71/kg. Other top importers of Chinese vegetable seed were the Netherlands (485,519 tonnes worth \$20.14 million or \$41.4/kg); South Korea (1,676 tonnes worth \$13.9 million or \$8/kg); Japan (420.7 tonnes worth \$9.7 million or \$23/kg); and Spain (3,515 tonnes worth \$5.28 million or \$1.5/kg). These five countries were also the top importers of Chinese seed in terms of volume, with Spain importing the most, followed by South Korea, the US, the Netherlands and Japan.

While the range in the average value of seed exported from China wasn't as wide as the average value of imports, it was

broad nonetheless. Namely, Spain paid on average \$1.50/kg of Chinese seed, while Vietnam, Bangladesh and Malaysia paid \$6.32, \$7.18 and \$7.43 per kg, respectively. In contrast, on the other end of the value spectrum, Chinese seeds bound for Jordan, Pakistan and the US were significantly more expensive, averaging \$112.5, \$60.13 and \$55.71 per kg, respectively.

According to APSA sources, China's seed exports to the US mainly comprised of leafy vegetable varieties, while those bound for the Netherlands were mostly legumes; those bound for South Korea were primarily hot pepper, and a majority of seeds exported to Spain were Chinese flowering cabbage.



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China Rice Seed Exports



A Chinese seed executive examines a sample of hybrid rice during a recent APSA Study Tour.

China is consistently the world's largest producer of rice, and has been tipped by the USDA to produce upwards of 144 million tonnes of the staple grain during the 2016-2017 marketing year. That's nearly 40 million tonnes or 36% more than the expected second largest producer, India. Most of China's rice is consumed domestically, however, many countries, mostly in Asia and Africa, particularly depend on China for rice seed, including unmilled paddy.

Asian Seed has obtained figures for China's rice seed exports, which have been broken down by volume, value and importing country. The value of Chinese

rice seed exported in 2016 ranged from as little as \$1 per kg (Uzbekistan, who imported 120kg at this rate), to as much as \$16.17 per kg (Fiji, who imported 300kg).

In terms of both gross volume and value, Pakistan was the top importer of Chinese rice seed last year, having imported a total of 8,446.18 t worth \$31.28 million, which equates to an average price of \$3.70/kg.

This was followed by the Philippines (6,506.28 tonnes worth \$20.03 million or \$3.08/kg); Vietnam (5,742.77 tonnes worth \$15.98 million or \$2.78/kg); Indonesia (1,758 tonnes worth \$5.23 million or \$2.90/kg); and Bangladesh (454.06 tonnes worth \$1.42 million or \$3.14/kg).

Country	Volume (kg)	Value (USD)
Pakistan	8,446,187	31,281,047
Philippines	6,506,282	20,029,535
Vietnam	5,742,775	15,985,558
Indonesia	1,758,475	5,227,905
Bangladesh	454,065	1,425,822
Nepal	88,444	285,247
Uganda	18,768	83,581
Sierra Leone	6,070	40,040
Congo	4,050	39,405
Angola	13,000	24,075
Fiji	300	4,850
Peru	400	1,528
India	120	290
Uzbekistan	120	120
Hong Kong	10	21
Thailand	10	50
Nigeria	5	8
Netherlands	1	3
US	1	1

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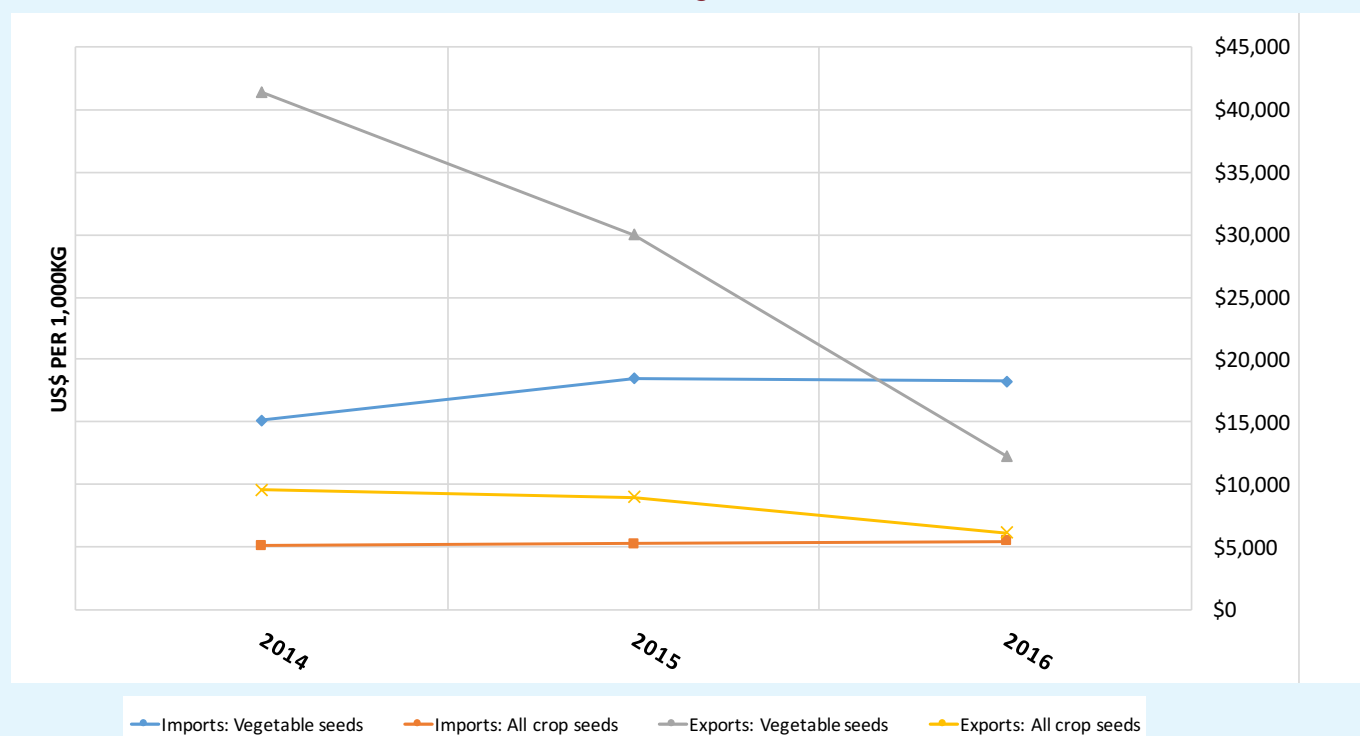
China Seed Trade Trends (Continued)

Seeds for Sowing	Million US\$			Tonnes			Price per tonne US\$			2015-2016 Change %		
	2014	2015	2016	2014	2015	2016	2014	2015	2016	Value	Volum	\$/tonne
Purple Alfalfa 紫苜蓿子	12.83	12.8	7.57	2,462	2,346	1,364	5,211.21	5,456.10	5,549.85	-40.86	-41.86	1.72
Clover 三叶草子	11.16	14.02	6.47	2,375	2,809	1,527	4,698.95	4,991.10	4,237.07	-53.85	-45.64	-15.11
Sheeps Fescue 羊茅子	27.11	22.13	14.06	14,018	11,024	7,742	1,933.94	2,007.44	1,816.07	-36.47	-29.77	-9.53
Kentucky bluegrass 草地早熟禾种子	18.81	20.6	7.95	4,770	5,057	2,016	3,943.40	4,073.56	3,943.45	-61.41	-60.13	-3.19
Ryegrass 黑麦草种子	32.41	33.22	25.76	21,437	24,242	20,403	1,511.87	1,370.35	1,262.56	-22.46	-15.84	-7.87
Maize 种用玉米	5.78	4.03	3.38	353	267	258	16,373.94	15,093.63	13,100.78	-16.13	-3.37	-13.20
Sunflower 种用葵花子	9.63	11.29	1.9	756	1,170	166	12,738.10	9,649.57	11,445.78	-83.17	-85.81	18.61
Sugar beetroot 糖甜菜子	10.07	16.91	8.73	346	598	306	29,104.05	28,277.59	28,529.41	-48.37	-48.83	0.89
Herbaceous flowering plants 草本花	11.83	17.89	14.3	38	71	21	311,315.79	251,971.83	680,952.38	-20.07	-70.42	170.25
Vegetable seeds 蔬菜种子	152.41	172.04	176.6	10,045	9,306	9,665	15,172.72	18,487.00	18,266.94	2.62	3.86	-1.19
Other sowing seeds, fruits and spores *	31.94	36.9	21.6	6,278	11,885	9,376	5,087.61	3,104.75	2,303.75	-41.46	-21.11	-25.80
TOTAL IMPORTS	323.98	361.83	288.3	62,878	68,775	52,844	5,152.52	5,261.07	5,455.11	-20.33	-23.16	3.69

China Crop Seed Imports (above) and Exports (below): 2014-2016

Seeds for Sowing	Million US\$			Tonnes			Price per tonne US\$			2015-2016 Change %		
	2014	2015	2016	2014	2015	2016	2014	2015	2016	Value	Volum	\$/tonne
Potato 鲜或冷藏种用马铃薯	1.008	0.483	0.935	109	11	20	9,247.71	43,909.09	46,750.00	93.58	81.82	6.47
Purple Alfalfa 紫苜蓿子	0.817	0.482	1.174	175	136	249	4,668.57	3,544.12	4,714.86	143.57	83.09	33.03
Maize 种用玉米	0.713	1.343	1.635	152	307	437	4,690.79	4,374.59	3,741.42	21.74	42.35	-14.47
Indica rice 种用籼米稻谷	63.388	58.106	74.348	20,228	18,705	23,005	3,133.68	3,106.44	3,231.82	27.95	22.99	4.04
Soybean 种用大豆	0.550	0.855	0.365	153	409	97	3,594.77	2,090.46	3,762.89	-57.31	-76.28	80.00
Sunflower 种用葵花子	4.061	2.300	0.374	911	527	34	4,457.74	4,364.33	11,000.00	-83.74	-93.55	152.04
Herbal flower plants 草本花卉植物种子	9.590	12.504	15.066	453	423	575	21,169.98	29,560.28	26,201.74	20.49	35.93	-11.36
Vegetables 蔬菜种子	175.952	161.199	113.178	4,252	5,383	9,176	41,381.00	29,945.94	12,334.13	-29.79	70.46	-58.81
Other sowing seeds, fruits & spores* 其他种植用种子、果实及孢子*	5.087	5.353	5.485	740	1,085	1,018	6,874.32	4,933.64	5,388.02	2.47	-6.18	9.21
TOTAL EXPORTS	261.17	242.63	212.56	27,173	26,986	34,611	9,611.23	8,990.77	6,141.40	-12.39	28.26	-31.69

China Average Seed Prices



Among the clear trends reflected in the data covering three years is the declining volume of Chinese seed imports coinciding with an increasing average price. This stands in contrast with exports, for which volume has increased while price has fallen.

Do you have statistics or insights that complement or contradict what is presented here?
We would love to hear from you. Please email Steven@apsaseed.org



CHINA SEED EXPORTS

- **Top countries to import Chinese potato seed:** Egypt (48.6% of the total), Saudi Arabia (20.1%), Turkey (18.6%) and Pakistan (8.9%).
- **Top importers of Chinese maize seed:** Vietnam (92.3%), Trinidad and Tobago (3.8%), Sierra Leone (1.5%), South Korea (1.2%), and Angola (1%).
- **Top importers of Chinese rice seed:** Pakistan (42.1%), the Philippines (26.9%), Vietnam (21.50%), Indonesia (7.0%) and Bangladesh (1.9%).
- **Top five buyers of Chinese alfalfa seed:** South Korea (58.7%), Japan (31.8%), North Korea (4.68%), the Netherlands (4.67%) and Canada (0.2%).
- **Top buyers of Chinese sorghum seed:** South Korea (81.86%) and Chinese Taipei (18.14%).
- **Top buyers of Chinese soybean seed:** Thailand (62.2%), the United States (24.6%), Vietnam (9%), Canada (2.2%) and Italy (1.8%).
- **Top buyers of Chinese sunflower seed:** Japan (36.2%), Kazakhstan (27.6%), the Netherlands (12%), Tanzania (10.3%) and Spain (5.6%).
- **Top buyers of Chinese vegetable seeds:** The United States (29.4%), the Netherlands (17.8%), South Korea (12.3%), Japan (8.6%) and Spain (4.7%).
- **Top buyers of Chinese herbaceous flowering plant seeds:** The United States (24.6%), Japan (20.4%), the Netherlands (16.8%), India (14.5%) and South Korea (10%).
- **Other types of Chinese fruit and sowing seeds and spores, top buyers:** Japan (45%), South Korea (43%), Pakistan (2.95%), the United States (2.6%) and Italy (0.85%).

The figures in these two panels are for the year 2016 and based on gross value of trade



CHINA SEED IMPORTS

- **Top suppliers of maize seed to China:** Germany (65%), Argentina (17.7%), France (15.6%), Chile (1.1%) and India (0.1%).
- **China's top suppliers of alfalfa seed:** Canada (63.4%), the United States (15.9%), Germany (10.5%), Australia (5.8%) and France (3.1%).
- **Top suppliers of clover seed to China:** Argentina (43%), Denmark (22.7%), Australia (16.5%), Canada (14.2%) and New Zealand (2.3%).
- **Top suppliers of fescue (*Festuca ovina*) to China:** The United States (93.76%), Denmark (3.4%) and Canada (2.84%).
- **China's top suppliers of Kentucky bluegrass seed (*Poa pratensis*):** The United States (79.18%), Denmark (20.02%) and Canada (0.80%).
- **China's top suppliers of ryegrass seed:** The United States (62.5%), Denmark (19.9%), Canada (15.8%), New Zealand (0.8%) and Argentina (0.5%).
- **Top suppliers of sorghum seed to China:** The United States (98.83%), France (0.79%), Australia (0.33%), Germany (0.03%) and Japan (0.02%).
- **Top suppliers of sunflower seed to China:** The United States (51.2%), Japan (27.8%), France (6.2%), Chile (5.1%) and India (4.4%).
- **Top suppliers of sugar beetroot seed to China:** Germany (40.9%), Belgium (31.8%), France (12.8%), Denmark (12.5%) and Italy (1.6%).
- **Top suppliers of vegetable seeds to China:** Italy (52.3%), Denmark (12.8%), Thailand (9.4 %) Indonesia (8%) and US (4.3%)
- **Top suppliers of herbaceous flowering plant seeds:** Japan (47.6%), the United States (34.1%), Germany (6.8%), France (4.7%) and the Netherlands (4.2%).
- **Other types of fruit and sowing seeds and spores, top suppliers:** The United States (54.3%), Canada (15.3%), Denmark (13.4%), Japan (6.5%) and Taiwan (2.8%).

18th Shouguang Seed Expo

APSA was well represented at the 18th Shouguang Seed Expo, which was held at the Shouguang Vegetable high-tech demonstration zone from 20 April to 30 May 2017.

Among the Chinese APSA members exhibiting at the major seed expo were Shandong Nuor Seeds, Beijing Zhongyan Yinong Seedling, Beijing Zhongyan Huinong Seeds, Rijk Zwaan, Shouguang Yinong Horticulture, Dayi Seeds and Jinan Tianrui Seed.

The event was organised jointly by China's Ministry of Agriculture, Ministry of Foreign Affairs, China Council for the Promotion of International Trade (CCPIT), People's Government of Shandong Province, Chinese Academy of Agricultural Science, Standardization Administration of China and China Agriculture University.

With the theme of "Green, Technology and Future", the aim of the event is to promote

domestic and international vegetable trade, agricultural supply reform, industry communication, and the sharing of new varieties, technology and equipment.

The total exhibition area spans 450,000 square metres, and included space for booths, field and cultural exhibitions, demonstrating some 2,000 vegetable varieties, 100 new technologies, 80 cultivation modes and 200 vegetable culture landscapes. 🌱



Photos by Li Xiaofeng



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All About Plant Breeding Innovation

APSA members who have participated in any of our recent technical sessions, or have been keeping abreast of the latest advances in seed breeding, at some point will have certainly heard mention of CRISPR-Cas, a cutting-edge gene-editing tool and one of the many latest breeding techniques in what is collectively being referred to as ‘plant breeding innovation’. But what is it really that seed scientists, policy makers and legislators are talking about? For more clarity on the matter, *Asian Seed* reached out to Michael Keller, ISF Secretary-General.

Concisely, what is plant breeding innovation? What technologies, mechanisms and tools does it include, and what does it not include?

Plant breeding innovation reflects the continuum of innovation in plant breeding. It does not focus on a particular group of methods, nor is it defined by them. The way we see it, the concept of plant breeding innovation is not a new one – the continuous development of new varieties in all crops is in our DNA! I mean, which other industry invests up to 25% of its turnover in innovation? In the infographic we developed (pp. 20-21), we wanted to convey the message that the latest methods of plant breeding innovation represent

an accumulation of knowledge and an evolution of methods – not a revolution.

In answer to the question, plant breeding innovation includes the whole range of tools that plant breeders use. Perhaps the most significant milestone in recent years has been the advances in genome editing. Under this umbrella, you have targeted mutagenesis which results in minor changes at a precise location in the DNA (e.g., ODM and SDN 1 and 2, which can be done with technologies such as ZincFinger, TALEN, and CRISPR-Cas). These methods have given us waxy corn, non-browning mushrooms and powdery mildew-resistant wheat. You also have cisgenesis which

involves the transfer of genes within the gene pool. Applications include the scab-resistant apple and the Phytophthora-resistant potato.

Many APSA members, especially breeders, have the impression that many of these newer technologies/innovations (such as CRISPR Cas9) are inaccessible and only financially-secure MNCs/organisations can afford to implement them in their programmes. Do you agree?

As I mentioned, consistency is central to our approach – and this applies to the terminology we advise our members around the world to use so that we are truly speaking with one

voice. As we are speaking about a much broader concept with regards to innovations in plant breeding, we use 'latest methods', as it is impossible to draw a line between newer and older methods in our continuum of plant breeding. For example, would you say that a method used since 2002 is new or old? The answer is subjective.

One of the biggest concerns plant breeders have is whether they'll be able to use the latest breeding methods, as social stigma and burdensome regulatory barriers could limit their use.

Indeed, the latest breeding methods themselves are financially accessible and we see tremendous opportunities for the whole seed industry, and for all crops. However, it is critical that regulatory burdens do not impede investment. If the burdens and the costs that they generate are too high, investment will be limited to high-value crops, and minor crops will not be in focus. In a world where we have to address global challenges such as climate change and population growth, and even consumer preferences, this will handicap our capacity to innovate.

Further to the examples you mentioned, can you provide any more recent examples of beneficial/successful applications of plant breeding innovation?

There is a real buzz around CRISPR-Cas9. The number of scientific publications speaking about "CRISPR" went from 36 in 2010 to 1,431 in 2016. And the number of articles in international newspapers about "CRISPR" went from 76 in 2010 to 3,553 in 2016 – that's ten articles per day!

Even if these articles cover much broader domains, gene editing technologies are already having an impact on the seed industry as they offer up new possibilities to unlock the untapped potential of biodiversity. However we have to keep in mind that by using CRISPR-Cas, plant breeders are combining their collective knowledge gained over the past 20-30 years – it's not just the use of one method. For example, by knocking out the expression of a single gene, breeders can increase

lycopene levels by 25 per cent, which would be in line with what consumers are looking for, like those deep red tomatoes with high lycopene. It also means shortening the breeding cycle compared to traditional plant breeding.

Some recent examples of improved varieties also using newer breeding methods are broccoli with increased antioxidants, easy to prepare salad, carrots with increased beta carotene, or more convenient snackable fruits and vegetables like seedless watermelon, baby cucumbers or grape tomatoes. Or for rice, with increased disease resistance or more efficient nitrogen use via the TALEN method.

What are the biggest opportunities and challenges you see with some of the specific plant breeding innovation technologies/tools mentioned above?

The industry's understanding of plants and their genomes is increasing each year, and it is this knowledge that has boosted our capacity for genome editing in recent years. Now is a great time to be in agriculture as we have a better understanding of genetics and plant biology, enabling us to develop improved plant varieties in response to global challenges such as climate change. For example, characteristics such as pest or disease resistance, as well as drought or flood tolerance. Of course, we will continue to use traditional methods, but the latest methods will help us better predict how the variety can be improved.

This increased capacity for greater precision and faster development – all with the plant's own DNA – makes genome editing methods like CRISPR Cas9 very attractive for many in the public and private research field. We also see opportunities for all type of crops and even minor crops.

Finally, I would like to emphasise that we are speaking a lot about the potential benefits for future generations of crops. It's important to be realistic and responsible, and to avoid overpromising.

As for challenges, let's be crystal clear. [Wide adoption of] Plant

breeding innovation will only become a reality if the regulatory framework within which we operate at national levels, and also in Asia-Pacific, is a workable one and does not hamper the use of these methods.

ISF's concept paper outlines consistent criteria that regulatory agencies and governments can utilise in determining the scope of regulatory oversight for products developed using plant breeding innovation tools. The paper recognised that the approach taken by governments to translate these criteria into regulatory policy would undoubtedly vary based on respective existing laws and regulation. However, the end goal is one that will ensure proper regulatory oversight while promoting facilitative approaches to how plant varieties are regulated. The underlying principle is that if the same product endpoint is reached through the latest methods as with traditional plant breeding, then they should be regulated in the same way.

ISF engaged with several of our national seed trade association members and with APSA to support their discussions and outreach with public breeders and other stakeholders in the value chain, as well as with governments, to participate in the organisation of roundtables and workshops.

Let's engage together to support plant breeding innovation and make improved varieties accessible in the Asia-Pacific region within a consistent regulatory framework. We must do everything we can to move toward more consistent policies for products developed through the latest plant breeding methods if we are to make them accessible and ensure uninterrupted trade.

One thing we have to remind ourselves of is that each one of us has to speak up to speak out and tell the wonderful story of plant breeding. If we speak as one, we can amplify our voice. Besides the regulatory framework, we also have to work towards consumer acceptance. 🌱

ISF recently published a Plant Breeding Innovation Discussion Guide as part of its stakeholder engagement activities, which will be available on apsaseed.org

MILESTONES IN PLANT BREEDING

CROP DOMESTICATION

Farmers select the best wild species to develop crops

Domestication of wheat

10,000 BC

MUTAGENESIS

Developing new genetic diversity by exposing crop plants to chemical agents or radiation

Blast-resistant rice

1940

HYBRID BREEDING

Crossing two genetically different individuals to develop better performing hybrids

More vigorous hybrid corn

1926

Understanding the structure of DNA

James Watson and Francis Crick identify the double helix of DNA

1953

PLANT BREEDING BASED ON

GENETIC INFORMATION

Development of improved varieties by working directly with the DNA



PLANT BREEDING BASED ON CROSS BREEDING

Development of improved varieties by combining good characteristics from two parents

Mendel's laws

Gregor Mendel describes the inheritance of traits from one generation to the next. His laws become the core of classical genetics

1865

FACTS

For **10,000** years, farmers and breeders have been developing and improving crops

For **150** years, plant scientists and breeders have improved plant breeding on a scientific basis

Today, farmers feed at least **10** times more people using the same amount of land as 100 years ago

By 2050, we will need **50%** more food to feed a population of 11 billion

GMO

Introducing foreign genes into the DNA of a plant

Insect-resistant cotton

1994

MARKER-ASSISTED SELECTION

Locating desirable traits in a plant for efficient selection and breeding

Barley resistant to yellow dwarf virus

2000

TARGETED BREEDING

Using modern tools such as genome editing for more targeted breeding

Waxy corn

now

future



International Seed Federation
Seed is Life

Phytosanitary Priorities

The demand for seed – in particular quality and certified seed – is rapidly growing in every single country and region of the world, posing immense opportunity and challenge for seed traders.

During a meeting of APSA's Standing Committee on Trade & Marketing at the 23rd Asian Seed Congress in November 2016, Dr. Keshavulu Kunusoth, an Executive Committee member of the International Seed Trade Association, underlined the industry's consensus for the value of the global seed trade to be growing with a CAGR of 9.4%. It is forecast to be worth \$92 billion by 2020, up from an estimated \$53.76 billion in 2014.

At the same meeting, Michael Keller, Secretary-General of the International

Seed Federation, revealed that in Asia alone, the value of seed imports more than tripled in a decade, worth about \$2 billion in 2014, up from \$600 million in 2003, while the value of exports into the region during that period more than quadrupled, from \$300 million to \$1.3 billion.

Pin it on climate change, overpopulation, ever volatile geopolitical factors or a combination of all of the above, demand is rapidly outstripping supply. Indeed, the rapid growth of the

seed trade not only poses immense opportunities for traders, but also brings with it a number of challenges, particularly in respect to phytosanitary standards. Seasoned traders are well aware of these challenges, underlined by increasing concerns over a multitude of biosecurity threats linked to seeds.

While no country is immune to these challenges, recent news headlines in Australia, China, India, Indonesia, New Zealand, Pakistan and Vietnam are particularly worth highlighting here.



Pests, Disease and Weeds

Australian biosecurity authorities have pulled out all the stops to manage various biosecurity threats promising significant economic loss. Among them are tomatato potato psyllid (TPP), chestnut blight, green mottle mosaic virus (CGMMV), banana Panama disease tropical race 4, myrtle rust, yellow crazy ants and fire ants, white spot disease, Russian wheat aphid, and Pacific oyster mortality syndrome. Some of these threats are suspected to have been imported to the island continent through contaminated seeds.

In Perth during February of this year, the first-ever detection in the country of the destructive tomato potato psyllid (TPP) ultimately resulted in the establishment of a quarantine zone of the city and surrounding locales. This led to phytosanitary-based trade restrictions and bans on Western Australia produce in eastern Australian states. Such emergency containment efforts are not only affecting key solanaceous crops, but other economic produce such as strawberries, with industry experts estimating economic losses from the bans being upwards of A\$80 million.

Compounding pest problems Down Under is the threat of migrating plant diseases, namely CGMMV, which has mostly affected cucurbit crops – watermelon, cucumber, melons, zucchini, pumpkin, squash, bitter gourd and bottle gourd – in West Australia, the Northern Territory and parts of northern Queensland.

Suspected to have come to Australia via contaminated imported seeds

supplied by undisclosed sources, CGMMV had previously been detected in 2015, despite strict screening efforts by the Federal Agriculture Department, who began imposing mandatory testing requirements on imported seeds in 2014. Australia's testing requirements reportedly call for a sample size of 9,400 seeds – more than four times the international testing requirement of only 2,000 seeds – prompting many to question whether said stringent efforts are stringent enough.

Also worth monitoring in Australian biosecurity affairs is an unprecedented class action law suit filed in Queensland in March. The suit was filed on behalf of a number of sorghum farmers who claim that the sorghum seed they had purchased was contaminated with the weed shattercane, or sorghum bicolor. While it is too early in the legal proceedings to draw any conclusions, the mere fact that a class action lawsuit on phytosanitary grounds has been accepted by a Supreme Court underlines the growing significance of biosecurity in the region.

Also feeling the economic heat from phytosanitary threats is New Zealand, whose pea industry has been adversely impacted by a two-year ban on the production of peas, imposed by the Ministry for Primary Industries (MPI) on pea farmers in Wairarapa, which had previously contributed an estimated 10% to the country's NZ\$100-million-a-year pea industry. The ban, effective since July 2016, was imposed following



Seed suppliers increasingly need to focus on quality control.

the MPI's biosecurity response team detecting the pea weevil in stored pea seeds several months earlier.

Also in New Zealand, the Federated Farmers group continues to work with the MPI to contain and prevent the spread of the devastating velvetleaf weed, initially detected in Southland in March 2016 and believed to have been unintentionally imported in contaminated fodder beet seed from Italy and France. Although steady containment progress has been reported, the main challenge with such a weed is that its seeds can reportedly remain dormant in the soil for as long as 60 years and still germinate.



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Bilateral Market Pressure



An Indian scientist selects seedlings for in-house phytosanitary screening tests.

Several other phytosanitary related regional trade issues in the region are worth highlighting. NPPOs in India and Indonesia have had to employ corrective measures to their consignment screening protocol after their counterparts in Vietnam imposed import bans and restrictions on various types of seed and produce reportedly found to be contaminated by the groundnut and seed beetle, *Caryedon serratus*.

Following a spate of plant quarantine detections of the beetle last year in thousands of tonnes of contaminated produce from Indonesia, Vietnam's Ministry of Agriculture and Rural Development (MARD), in January this year, formally announced bans on the import of Indonesian tamarinds, peanuts, sickle senna seeds, cocoa seeds and string bean seeds, justifying the extreme measure on the fact that it had previously sent several notifications to Indonesian counterparts to no avail.

Then, in March, similar bans were also announced by MARD on the import of Indian peanut pods and seeds, as well as seeds of cassia, cocoa beans and tamarind fruit. The Vietnamese NPPO cited the detection of the same beetle responsible for the Indonesian ban in at least two Indian shipments. Indian NPPOs initially reacted by imposing their own ban on imports of Vietnamese pepper, coffee, bamboo, cassava, cinnamon and dragon fruit, citing phytosanitary grounds related to fumigation accreditation protocol in Vietnam. The reciprocal restrictions fuelled an uproar by affected traders, particularly those dealing in Vietnamese pepper, who depend on India, Vietnam's third largest market. The trade bans

were ultimately lifted by both countries after their respective NPPOs agreed to employ corrective measures.

Market pressure is a commonly cited factor for NPPOs relaxing, if not outright compromising, stringent phytosanitary standards. Take cotton demand in Pakistan for instance. Despite a looming import ban on unginned Indian cotton, Pakistan's Plant Protection Department (PPD), in December 2016, had no choice but to conditionally permit the delivery of 12,000 bales of the seeded-commodity from its South Asian neighbour.

The cotton in question, which was imported by a consortium of spinning mills, had initially been held up at a port on orders from the PPD, who cited the failure of the consignment to fulfill phytosanitary requirements that require the lint to be free from seeds. The matter was finally "sorted out" following a high level meeting between representatives of the All Pakistan Textile Mills Association and the PPD. One reason the cotton was finally released for delivery was cited as a shortage in domestic supplies. Pakistan is reportedly the third largest cotton consumer in the world, while India has traditionally been the largest supplier of cotton to Pakistan.

Asian Seed regularly comes across reports of rice and bean producers and exporters in Cambodia and Myanmar, for example, who are increasingly impacted by stricter phytosanitary protocol being employed by China's General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ). The ministerial-level department oversees the administration and enforcement of matters related to import-export quality

control, commodity inspection, animal and plant quarantine, food safety, and certification and accreditation standards. In addition to constantly revising its PRA (Pest Risk Analysis) and MRL (Maximum Residue Limits) requirements, China has also introduced new QR-code label tracking requirements for seed packaging, as reported in issue 1 of *Asian Seed*.

Despite China's increasingly stringent inbound screening efforts, a few recent headlines have put the country's outbound supply chain links into question. Most recently, India's NPPO imposed an import ban on apples, pears and mairgold seeds from the world's most populous country. Citing detection of pests, including mealy bug (*Pseudococcus comstocki*) and fungus (*Fusarium oxysporum*) in an undisclosed number of consignments from China since the start of the year, the Indian NPPO issued a letter to its Chinese counterpart in May informing them of the ban, effective 1 June.

While corrective measures are being implemented so as to resume trade as soon as possible, the move has reinforced the need for China's AQSIQ to more closely scrutinize its outbound supply chain links, compounding an earlier biosecurity incident in December 2016, when Indonesia's Agriculture Quarantine Body confiscated and destroyed 5,000 chilli plants, as well as an undisclosed number of onion plants allegedly grown from contaminated seeds imported from China.

The plants, which were found to be contaminated with the destructive bacteria *Dickeya dadantii* (*Erwinia chrysanthemi*), were taken from a plot in Bogor, about 60km south of Jakarta. Four Chinese nationals, who had reportedly imported the seeds and planted them on a rented 4,000-square-metre plot of land, were detained in the incident. Curiously, the incident fueled a wave of "fake news" hysteria, framed in some social media threads as a deliberate "biological attack". This case underlines the risks of how easily a relatively small phytosanitary incident can be blown out of proportion in today's day in age, in which news spreads rapidly, especially 'bad news'.

In some cases many months or years may pass before a biosecurity threat is detected, let alone made public. Take the case of some Vietnamese sweet basil seeds recalled in California in May. According to the US FDA, an

undisclosed quantity of the seeds had been exported to California since October, 2015 before the importing company "voluntarily" announced a recall of all the seeds it had distributed during the 19-month period, citing the detection of salmonella in some of the packages. Lacking specific test results covering each link in the supply chain, it is impossible to verify the source and degree of contamination at this point.

All aforementioned cases underline the growing importance and awareness of phytosanitary standards in the Asia-Pacific region. If one thing is to be taken home from this, it is the value and advantage of NPPOs and seed traders adopting pre-emptive measures and tackling any potential issue before it can become news. Make no mistake, seed traders and NPPOs in every country in the region have to be increasingly diligent in monitoring and mitigating potential biosecurity threats. But progress is being realised across the board, especially in developing countries.

One noteworthy indicator to highlight in the region is Cambodia's Ministry



Indian and Chinese seed company executives discuss seed movement protocol.

of Agriculture announcing plans this year to open six Sanitation and Phytosanitation (SPS) offices in key border market trade areas. The offices, located in the Stung Treng, Preah Sihanouk, Svay Rieng, Tbong Khmum, Battambang and Manteay Meachey

provinces, will focus on inspections of imported produce from neighbouring countries, ensuring compliance with established phytosanitary measures.

We expect to see more pre-emptive measures in neighbouring countries.

Adoption of ISPMs

Beyond improving standards at the national level, in moving forward it is important that the harmonisation of standards be realised at the regional and global levels. At a 6 April meeting in South Korea, the International Plant Protection Convention (IPPC) agreed to adopt a new seed-specific International Standard for Phytosanitary Measures (ISPM).

The meeting, attended by NPPOs from around the world, was held as part of the Twelfth Session of the Commission on Phytosanitary Measures (CPM-12). The development was hailed as a successful result of decades long work by the US and international seed industries, led by the American Seed Trade Association and ISF.

According to the ISF, the ISPMs will allow companies to move seed for planting across borders with greater efficiency, while minimising and managing the risks associated with the movement of seed.

Michael Keller of the ISF lauded the decision as "essential for the development of new plant varieties, and the availability of pest-free,

high-quality seed, which is a major pre-condition of global food security".

But adopting the standard is only the first part, Mr Keller stressed, emphasising that it will be up to the 183 IPPC member countries to implement the standard, which provides guidance on how to identify, assess and manage the pest risk associated with seeds to NPPOs.

Reinforced with the support of key international seed trade bodies, including the ISF, ASTA and APSA, the ISPMs will be rigorously tested through to October 2018, an implementation period during which national seed associations will be encouraged to work closely and engage with their NPPOs on changes in the national phytosanitary requirements that may result from this standard. 🌱

Phyto Feedback

To identify phytosanitary strengths and weaknesses in Asia Pacific countries, APSA has launched a questionnaire for members who import and/or export seeds to and from the region. Please take 10 minutes to share your insights and experiences with us by scanning the QR code to the right.



Women In Seed: Dr. Marti Pottorff



Dr. Pottorff presents at the ASRT 2 Field Day in February.

In our highly-anticipated launch of the 'Women In Seed' column, we are pleased to feature Dr. Marti Pottorff, an accomplished plant pathologist actively involved in disease-resistance breeding. Dr. Marti has been based at the World Vegetable Center's Tropical Research Station at Kasetsart University's Kamphaeng Saen campus since December 2016, having transferred from WorldVeg's headquarters in Chinese Taipei. An expert in Agricultural Plant Science, Genetics and Botany, Dr. Marti has a Ph.D. in Plant Biology/Genetics and has a post-doctoral position working in the field of plant pathology, with a focus on fungal diseases.

What's a typical 'day in the life' for a plant pathologist?

My days are varied and that is why I like my job. Some days I visit trials in the field or greenhouse to observe and plan out activities and experiments, other days it is working on the computer, writing papers and proposals for future experiments, reading scientific papers, and budgeting and planning projects. Some days it is performing experiments to determine anthracnose resistance, analysing data and writing up the results. I think the most fun part of research is forming the hypothesis, designing the experiment to answer the question and then finding out the answer.

We have been improving the lab for plant pathology and basic molecular work. This involves a lot of purchasing of new equipment, chemicals and reagents, and studying protocols to make decisions on how and what we will need to carry out specific experiments. I am also managing an internal genetic mapping project to identify molecular markers linked with resistance to anthracnose – a fungal disease prevalent in SE Asia and many other parts of the world – in chilli peppers.

My team, which includes myself and three research assistants, is working on [breeding] resistance against two major pathogens which host the disease. Namely, *Colletotrichum acutatum* (C. scovillei) and C. *truncatum*. We are also working on the development of cultural and biological control of anthracnose and potential studies of other major fungal diseases in bitter melon.

In your line of work, have there been any particular challenges and/or advantages for you as a female?

I think that there is a natural inclination of people of the same gender to have a better understanding or comfort level with their own gender. Therefore, if you are a woman in a predominantly male organisation, you may not feel as comfortable or fit in as easily. You might even have to speak a little louder to be heard or noticed. A woman might have to work a lot harder to gain respect and recognition.

As for advantages, yes, maybe this is a stereotype, but women in general are known to be good communicators and listeners. Women often try to work together in a team rather than in isolation. When I was growing up in the US, women were often subjected to traditional roles, being a teacher or playing supportive roles. Some women in research may be less intimidating and therefore easier to approach, talk to and work with. But of course these are generalisations. I have met many female professors who were quite intimidating! Gender is a component, but at some point it boils down to the individual.

HM●CLAUSE





ABOVE: Dr. Marti on a recent trip to Fiji as part of her work with pathogens; BELOW: Dr. Marti with her research team.

Any other stereotypes, unfair social norms you've faced or overcome?

I think that I face the Asian-woman stereotype, especially while working in Asia. My racial identity is Korean, but my cultural identity is American. There are assumptions that Asian women are meek and mild mannered, I am actually quite the opposite! But I have felt the need to be culturally sensitive to the norms of my colleagues in Taiwan and Thailand. I have actually found myself more quiet; I try to control my normal reactions which might be seen as aggressive or not the norm. I am still myself though, but try heavily not to offend anyone. I have found huge cultural differences between SE Asian culture and American culture, and it can be quite challenging sometimes, but it is a great experience overall and a chance to reflect on my own cultural norms and question what is the best way to live/interact. I try to overcome cultural differences by being direct and honest. At least there is no question as to what I am trying to say.

Tell us more about your cultural background and path to seed.

I am Korean-American, I grew up in York, Pennsylvania (USA), which is a rural farming area. My parents had a very large vegetable garden that would produce most of our vegetables for the summer and we also had some apple trees, grapevines and walnut trees. My whole family were involved in taking care of growing and harvesting vegetables. We went to a lot of local farmers' markets to buy fresh produce, or even to local farms to buy big bushels



of fruit and locally produced milk. I still really enjoy going to local farmers' markets or markets selling fresh fruits and vegetables. The atmosphere is so vibrant. Along the way I've explored and considered many different career fields: nursing assistant, food preparation/cake decorator, librarian, computer technician, clothing design, photography and performing military ceremonies. I even tried my hand as a car technician while in the US Navy.

Ultimately, I started to develop an interest in house plants and the genetic relatedness of certain types and realised that maybe I should have studied plants. That and probably my family's large vegetable garden and the influence of farming communities are what led me to the career that I am in now.

My earliest memory of seeds and the business is planting Silver Queen white corn in our vegetable garden every year. The seeds were always a bright pink colour which was probably a fungicide or patenting of the seed from the company. My father would always prepare the tomato seedlings

in the window several months in advance, during the winter season. We would always eat our own produce, lots of salads and cooked vegetables. I would find it strange that our neighbours would eat vegetables out of a can. York, PA, is an agricultural area, so much of the landscape is large farms.

What are your goals and philosophy on life in general? Any parting advice?

I am a mother; I have a six-year-old son. My partner and I both have Ph.D.'s in plant science. My partner is working on Arabidopsis (a model plant system) doing fundamental research, whereas my research is more focused on genetics/genomics for application to improve plant varieties. Moderation, or walking the middle path, is key. Try to keep a healthy balance in all areas of your life. Personally, I want to continue to make a contribution to improving the food supply and people's access to nutritious and healthy vegetables. Since I have moved to the region, I have been a bit more involved in plant pathology, and home garden projects in Cambodia, Fiji and the Solomon Islands. I have enjoyed the creative process, helping to support regional projects with my technical knowledge or inputting my ideas for future projects to increase vegetable production and consumption in developing countries. I have also mentored quite a lot of visiting researchers and undergraduate students. I enjoy this process very much and hope that I have been a positive influence; giving the younger generation a chance to explore career possibilities in research for development organisations. 🌱

For the full, extended version, please go to APSASEED.ORG

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From Genocide to Agronomy: APSA's Rawandan Intern



APSA had the pleasure of recently welcoming Rawandan national Paul Hategekimana on board as an intern.

An agriculture student – pursuing a graduate degree at Kasetsart University – Paul interned at APSA for eight Wednesdays, helping catalogue and update our databases, documents and publications. *Asian Seed* sat down with Paul to learn more about him and his tiny-yet-widely known country in the heart of Africa.

Paul was born in a historical and touristic town in southern Rwanda called Nyanza, which was the old capital from 1958-1962 and is the location of the monarchy's old palace.

"My family, which comprised of my mum, dad, sister, grandparents, uncles and aunts, was very rich. But they were all killed during the genocide and civil war in Rwanda, which began around 1994, when I was still only four years old. I was the only survivor out of my family," Paul remembers.

Persisting through a tough childhood, Paul was looked after by a family friend at first, but that man died in 1999, prompting Paul to take care of himself from a young age.

When asked about his choice to study agriculture, Paul explained, "I have some land from my parents. On one field, I've experimented with growing crops, but I couldn't do that much when I was young. I allocated some of the field for some local people to look after in addition to my own plot. In the future, I intend to go back and farm this land."

He began taking a liking to science during his secondary school years, having attended the Nyanza School of Science, where he gained a good foundation in maths, biology and chemistry.

Graduating in 2009, Paul would later go on to pursue an agriculture degree from the National University of Rwanda from 2011-2014.

At Kasetsart University he is now

pursuing a Master's Degree with a focus on tropical agriculture, and plans to graduate in 2018.

"I am researching crop physiology and seeds [of crops with] resistance against drought and diseases, as well as plant breeding for increased productivity," he said.

When asked why he chose to further his studies in Thailand, he replied, "Thailand is a very developed country in agriculture, more so than Rwanda. Thailand and Rwanda are collaborating on technology development involving rice and maize. In Rwanda, breeding new rice varieties is currently very expensive."

"As an agronomist, I need to figure out how to change the mindsets of Rwandan farmers. In Rwanda we have two seasons: rainy and sunny, but mostly during the sunny season it is considered the 'off-season' for agriculture."

"But here in Thailand, agriculture production is running year-round. I think if we apply this in Rwanda we can increase yields and productivity. I will show our farmers that we need to think more on other sources of water for agriculture, not just to be dependent on rain patterns, which are increasingly unpredictable in light of climate change," he continued.

Paul went on to share his view on seeds and underlying expectations for interning at APSA.

"Seeds are key for better yield production. Seed treatments and enhancements will facilitate increased production. Thus it is wise to know how to choose the best quality seeds so as to maximise production."

"Interning at APSA has been a great opportunity and has helped me to increase my knowledge of seed selection, seed treatments, farmer cooperation, agricultural business development and demonstration plot establishment," he concluded.

Stay tuned for a follow up 🐦

Thailand PVP 101

Home to some 12,000 known vascular plant species with an exponential number of cultivated, wild and as-of-yet-to-be-discovered varieties and cultivars, Thailand is among the most biodiverse countries on the planet.



Thai PVP officers regularly take part in field inspections and demonstrations.

Though not a member of UPOV, Thailand utilizes its own unique Plant Variety Protection (PVP) law, procedures and protocol to ensure the sustenance and conservation of the kingdom's rich biodiversity, if not facilitate fair play in the marketplace. *Asian Seed* recently visited the Office of Plant Varieties Protection in Bangkok to learn more about PVP in the Kingdom.

The office oversees all official matters and procedures for Plant Breeders Rights (PBR), and plant-specific Intellectual Property Rights (IPR) in the kingdom. These include the granting of PVP certificates for new varieties, as well as entering into public and private Access and Benefit Sharing (ABS) agreements to develop existing Thai varieties, both cultivated and wild, as stipulated by the Plant Varieties Protection Act, B.E. 2542 (1999).

Since the law was enacted, the office has received PVP applications from public and private entities for 1,332 new varieties, 433 of which have been granted PVP Certificates of Registration, with the remaining applications under consideration.

The estimated timeline for granting a PVP certificate, from time of application to issuance, can range from 2 to 10 years. According to the PVP Office, the primary factor is the type of plant species. For example, the application window for perennial plants or leafy vegetables is shorter than that of woody plants or fruiting crops, the latter of which have longer grow cycles and thus require more time to examine.

It should be noted that at present, Thailand does not officially recognize PVP certificates issued in other jurisdictions and it goes without saying that to ensure full protection in Thailand under Thai PVP law, applications must be filed with the Thailand PVP office.

Beyond IPR, the Thai PVP office is also the designated authority for authorizing use of Thai plant material (both general domestic plant varieties and wild plant varieties) in research and development for commercial purposes (Section 52), in addition to processing notifications for using Thai plant material in non-commercial research (Section 53).

If the intent of research is commercial, the respective protocol is outlined in Section 52 of the PVP Law, which stipulates that the research entity enter into an ABS agreement with the PVP office. Since the PVP Law does not prescribe specific criteria for determining exact benefits, applicants are advised to propose benefits to the PVP Office. A committee established by the Dept of Agriculture will consider each application on a case-by-case basis using their own specific criteria, noting that the final agreement must be kept confidential between parties.

According to Section 52, if the research is purposes of variety development, education, experiment or research for commercial interest, the applicant is obligated to submit research objectives and ultimately the final results to the PVP Office.

Benefits typically are in the form of a profit-sharing arrangement, in which a certain portion of the profits derived from the respective plant material as determined in the agreement, is remitted to the Plant Varieties Protection Fund, which is used to subsidize and assist in a number of plant variety conservation, research and development activities as prescribed in Section 55 of the PVP Law.

The Thailand PVP Office currently has 25 such ABS agreements.

In the event that an entity wishes to use Thai plant material for research in which the intended outcome is not commercial, the protocol is outlined by Section 53. The outcome of this will be the Department of Agriculture issuing an official notification, which will be issued to the applicant directly by the PVP Office. At the time of press, the Thai PVP Office has processed 129 notifications under this category.

At present, all applications and agreements must be made in Thai language; however, the PVP Office has English-speaking staff who are happy to advise on specific procedures. 🇹🇭

Open weekdays 8.30am-4.30pm (barring national holidays), the Thailand PVP Office is located in the Pochakorn Building of the Department of Agriculture, next to Kasetsart University's Bangkok campus.

Their website is doa.go.th, and their phone number is 02-940-7214.

DISCLAIMER: The information provided is presented as a general guide and all specific inquiries should be taken up directly with the Thailand PVP Office via the contact details above.



Thailand has its own unique criteria and procedures for PVP. Photos: Supplied

Myanmar Seed Sector Germinates with NSA

Rapid progress is being realized within the seed sector of Myanmar, which has made leaps and bounds in recent months. Among the key developments to highlight is the recent establishment of a national seed association.

Coinciding with the registration this year of an NSA, key private and public stakeholders in April launched the Integrated Seed Sector Development (ISSD), a four-year programme to be reinforced by a budget of Euro 1.5 million from the Dutch Government. Entitled “Integrated Seed Sector Development Myanmar (ISSD Myanmar) – Developing a Vibrant Public-Private Seed System for Rice, Oilseeds

and Legumes in the Dry Zone” the project was launched under a vision of developing “A vibrant and pluralistic seed sector that caters for the quality seed need of smallholder farmers in the Dry Zone of Myanmar.” The main implementing partners of the project are Wageningen Centre for Development Innovation, the Department of Agriculture, Ministry of Agriculture, Livestock and Irrigation, Myanmar and an NGO or Consultancy, yet to be announced. According

to the Myanmar Information Management Unit, the Dry Zone “covers more than 54,000km, encompassing 58 townships which span from lower Sagaing region, to the western and central parts of Mandalay region and most of Magway region.” Approximately one-quarter of the country’s population live in this area, according to the MIMU. The expected impact of the program is “Improved food security and climate resilience of smallholder farmers in the Dry Zone of Myanmar” while its main objective is to “improve smallholder farmer access and uptake of quality seed of improved and well adapted varieties to sustainably increase agricultural productivity.” 🌱

Project name	Integrated Seed Sector Development Myanmar (ISSD Myanmar) - Developing a vibrant public-private seed system for rice, oilseeds and legumes in the Dry Zone
Vision	A vibrant and pluralistic seed sector developed to cater to the quality seed needs of smallholder farmers in the Dry Zone of Myanmar
Impact	Improved food security and climate resilience of smallholder farmers in the Dry Zone of Myanmar
Goal	To improve smallholder farmer access and uptake of quality seed of improved and well-adapted varieties to sustainably increase agricultural productivity
Outcomes	<ul style="list-style-type: none"> Improved seed sector coordination; Increased business performance of EGS producing seed farms; and Increased local availability and uptake of quality seed at affordable prices for smallholder farmers.
Key Indicators	<ul style="list-style-type: none"> 75,500 farmers benefit from quality seed in the Dry Zone; 28 new improved and well-adapted varieties of rice, legumes and oilseed crops promoted; 3,375 metric tonnes of additional quality seed produced in the Dry Zone; 180 local seed businesses and six seed companies engaged in professional seed production and marketing; Dry Zone seed sector platform established at zonal level and regional seed grower associations established in Nay Pyi Taw, Mandalay, Sagaing and Bago regions, resulting in improved seed sector coordination; and A national Seed Association of Myanmar established and supported to solve the most important seed policy and seed value chain issues.
Project sites	Nay Pyi Taw, Mandalay, Sagaing and East Bago regions
Duration	Four years (2017–2020)
Budget	Euro 1.5 million
Donor	DGIS, Ministry of Foreign Affairs, the Netherlands
Main implementing partners	<ul style="list-style-type: none"> Wageningen Centre for Development Innovation (lead partner); Department of Agriculture (Myanmar); Ministry of Agriculture, Livestock and Irrigation (Myanmar); and NGO / Consultancy company (TBD)
Contact person	Dr. Abishkar Subedi, Wageningen Centre for Development Innovation E-mail: abishkar.subedi@wur.nl Tel.: +31 317 482252



LEFT: The ISSD signing ceremony; RIGHT: Myanmar has a lot of untapped potential, Photo: Asian Seed Congress 2016



Asian Seed Pioneer Reflects on Six Decades of Progress

Dr. Kuldip Raj Chopra, 83, is an integral and pioneering member of the Indian and Asian seed industry and served as APSA's second President, from 1996 to 1997.

I was born 7 November 1933 in Lahore, in what is now Pakistan. I am the third of seven children and was affectionately named Kuldip ('Kul' means 'family' and 'dip' means 'light', so my name means 'light of the family').

After primary school, I attended a government high school in Lahore before moving in 1947 to Allahabad, in Uttar Pradesh, central India. There I attended Allahabad Agricultural Institute, graduating in 1953. The institute was co-founded by Dr. Sam Higgonbottom, an American missionary who designed the curriculum to put emphasis on field work and practical training, which would prove to serve me well in my career. By 1956 I completed my Masters in Agricultural

Botany from Allahabad University. The mid-fifties [decade] was a crucial period in India's agricultural sector. Crop yields were low because organised mechanisms for the dissemination of new varieties and new technologies didn't exist.

Agriculture was an area overseen by the states and there was hardly any coordination, even among scientists working on the same projects among states. Additionally, no organised seed multiplication and distribution system yet existed.

These issues were being debated at the highest levels in the Government of India (GOI), namely with the Indian Council of Agricultural Research and related research institutions. In 1955, GOI approached

the Rockefeller Foundation (RF), who at the time were supporting programmes in Mexico and Columbia to establish effective agricultural research systems, production of quality seed of superior genotypes and their respective marketing networks. RF accepted the invitation and sent two experts to study the prevailing R&D systems.

RF submitted their report in 1956 which was accepted in toto by the GOI, which led to the establishment of the "All India Coordinated Projects" system for each major crop, starting with maize in March 1957. This approach to R&D is well documented.

Destiny brought me in touch with Dr. U. J. Grant, who was the then RF Deputy Director General and Maize Breeder. Thus my professional career began as a research assistant at IARI, Pusa, New Delhi, where I worked from 1957 to 1959 in the All India Coordinated Maize Improvement Project, which involved a unique approach to breeding in which three key stakeholders – ICAR, State Agriculture Universities and the RF – cooperated in collecting and characterising germplasm so as to develop stable lines of resilient, high-yielding, disease-and-pest-tolerant maize hybrids.

I became a Junior Maize Breeder with RF, conducting maize improvement work in four main projects and at nine sub stations, where I was actively involved in identification, breeding and the official release of the first commercial maize hybrids in 1961, marking the start in India of the "Hybrid Era" and later the "First Green Revolution".

From 1961 to 1964, I studied at the University of Nebraska, Lincoln, USA, where I obtained a Ph.D. in Agronomy, before joining as a breeder in the All India Sorghum Improvement project, from 1964 to 1966.

By the mid-sixties, superior hybrids and varieties had been identified and released for cultivation in India, and USAID, along with RF, was assisting in establishing seed production, processing, quality control and marketing networks. Their mandate was to promote both the public sector (central and state seed corporations), and progressive seed merchants and farmers in the private sector.

Destiny again guided me and on advice from Dr. Lee House, RF Sorghum Breeder, I was one of the few qualified professionals to resign from a secure government job and accept the challenge of setting up an efficient R&D and production system for a small seed company from 1966 to 1971 in the country's nascent private seed sector. The company is now the largest private sector seed company in India.

From 1971 to 2002, I was a shareholder and promoter director of Mahendra Hybrid Seed Co. Ltd., one of the then leading,

research-based companies in the private sector specialising in improvement, production, processing and marketing of proprietary and public-bred varieties and hybrid crops (like sorghum, pearl millet, maize), oilseeds (such as sunflower), fiber crops (like cotton), and many tropical and temperate vegetable crops.

From 2002-2014, I was a shareholder and Managing Director of Biostadt MH Seeds Ltd., with a similar mandate to my previous role. Since 1973, I have worked as a consultant with the FAO, World Bank and affiliates in the field of seed industry development. Over the years I've done over 28 consultancies, with the most recent ones concerned with setting up R&D systems, privatisation of government controlled systems, on-farm seed production, establishing effective seed production, and marketing networks in both public and privately controlled economies.

In addition, I've conducted training programmes for the FAO and World Bank sponsored trainees, primarily in the field of establishing efficient seed production and marketing systems in developing economies.

In September 1973, ICAR sent an FAO-sponsored team comprising of young seed entrepreneurs from Africa to visit Mahendra Hybrid Seeds company production centres. FAO team leader Dr. Wagner – a senior officer from the FAO seed unit in Rome – was highly impressed by our in-house R&D, production and quality control systems.

In January 1974, I received an unexpected consultancy offer from the FAO to study seed infrastructure in Cameroon and Sri Lanka and develop a programme for quality seed production and sales networks with a focus on bolstering the nascent private sector.

This report was highly appreciated by the FAO seed unit for its simplicity and cost effectiveness, and especially for its guidance on the use of available consultant resources. I preferred consultancies in Asia, and between 1992 and 1998 my assignments were primarily in Bangladesh, Burma, China, Nepal and Sri Lanka – many of them for the FAO regional seed unit in Bangkok, administratively reporting to Mr. Mogens Lemonius.

During this 5-6 year period interacting with the public and private seed sector (mostly vegetable seed importers and distributors), I realised that they needed:

- Exposure to success stories from neighbouring countries, especially India, hence a forum for interaction with counterparts;
- Judicious use of available funds for setting up small R&D projects, and related suited technology and local government support to minimise risk of failure;

- Access to new, developing seed-related technologies; and a
- Platform for transacting business.

From the mid-seventies I have been associated with the Seed Association of India (SAI) as Director and later as its President. This association had membership from the public and private sectors' large and small organisations. I often discussed the benefits of being a member of SAI and the services it provided to new entrepreneurs, especially interactions among members and building confidence. SAI frequently met with the GOI, state governments and policy makers to resolve issues and problems faced by its members.

I always got positive responses whenever I discussed the creation of a regional forum with seed entrepreneurs and officials of countries I visited. The question was how and who will take the initiative. FAO, with its regional office in Bangkok, appeared to be most suited; hence I discussed the possibility of creating such a forum with Mr. Lemonius, whom I was reporting to after each consultancy. He was also convinced that such a forum would be ideal for addressing the problems and queries of small seed entrepreneurs from the region and agreed to discuss the financial needs of such a project in the initial years with FAO headquarters.

In 1992, the FAO regional office, under leadership of Dr. R. S. Paroda, organised a meeting of Agricultural senior level officials, policy makers and seed entrepreneurs from the Asia-Pacific region in Bangkok. Mr. Lemonius and I discussed our proposal for a regional seed association with him. He invited us to present a brief outline of our proposed model to all participants. To our surprise this proposal received overwhelming support and a "Preparatory Committee" was constituted.

I was elected its Chairman and the resolution requested Mr. Lemonius to seek FAO funds to start the project. Mr. Lemonius' zeal and persistent follow-up bore fruits and the FAO ultimately committed \$2 million as a seed fund to meet all expenses in the initial period. The Preparatory Committee met five to six times from 1992 to 1994 to draft a constitution and bylaws and associated legal procedures. Office space was provided by Thailand's Department of Agriculture.

Mr. R S Arora, Mr. Simon Groot and Mr. Manas Chiavanond, among others, deserve special mention for their contributions early on. Under Mr. Lemonius' leadership, APSA organised its first conference at Chiang Mai in 1994. It was attended by about 200 delegates. Participants included members from large and small companies. A few from Europe and the US also attended as Associate Members and a few technical papers were presented.

The second APSA Congress was held in New Delhi, India, in 1995. It was hosted by the Seed Association of India. Over 500 delegates were registered, giving immense satisfaction to organisers and APSA committee members. I was elected as incoming President.

Lo, an alternative to FIS/ISF was born, and quickly grew into a teenager and an adult. We had not expected the pace at which APSA grew. I understand that its current membership is approaching 700 and its financial position is robust.

I wish APSA steady growth and request that they should not forget the objectives for which it was created, stay away from groupism and, together, march ahead in the service of the region's seed sector. 🌱



APSA's second president Dr. Chopra with APSA Founder, Mogens Lemonius.

Smart Seed: You Ask, Our Experts Answer



Mr. Johan Van Asbrouck, Chair of APSA's Seed Technology Standing Committee (SC), recently led a live webinar to guide members in understanding factors of "Seed Shelf Life". The session was broadcast live from the APSA Secretariat Office in Bangkok. Mr. Asbrouck, who is also the Executive Chairman of Centor Group, Thailand, underlines the ideal conditions for storing seed, including environment, moisture content and viability.

As seed warehouse managers, how should we best decide which seeds get stored till next season and which seed lots should be sold this year? – Anonymous, Beijing

Ask this question to five different companies and you may get five different answers. Some will insist on a 'first in first out' logic. Others look

to seed quality and vigor to determine which are to be sold or stored. Many will sell the ones closer to the door just because that's what's easiest. Some ex-rated agent? Or you could use a controlled deterioration test. There is no right or wrong answer for all companies. In respect to optimal seed storage, one has to consider two main conditions. The first is environmental, referring to temperature, moisture content and oxygen levels. The other is seed related conditions, including seed quality, genetics and maturity. You need to consider both. But the two most important factors among these are the moisture content and maturity of the seed. There are several rules for managing moisture content, including Bradford's Rule, Harrington's Rule and the Metronome Rule, which are explained in detail in the webinar, which can be found on the APSA website.

Can seed drying replace cold storage? Or is drying another additional step to be done so that the longevity can go up further? – Geetha Madhuri P

On both parts, the answer is yes. It depends. We've done a lot of capacity building work with companies in Bangladesh, where we demonstrated that it is possible to store seeds for long periods – two years – without the germination rate of seeds reducing significantly. However, important conditions have to be met, in which the water content is regulated closely so that you meet 25% equilibrium RH. So for most vegetables this would be around 6% and 8-9% for other field crops, for example. That being said, you can combine dry storage with cold storage in your chain. Without cold storage however, you can really maximise your storability. The best way to check is to use what is called the Ellis & Roberts equation, for which we've developed a spreadsheet using this formula for various crops, which we will distribute to Seed Technology Standing Committee members who were in attendance at our last Asian Seed Congress in Incheon. 🌱

The Seed Storage webinar can be viewed in full on apsaseed.org. Johan Van Asbrouck welcomes questions about seed storage and seed technology in general. He can be contacted directly via email (johan.rhino@gmail.com).

Do you have other seed technology related questions to be addressed in future webinars and in Asian Seed? Please email us your questions and suggestions (steven@apsaseed.org).

New APSA Members

KHAN AGRICULTURAL PRODUCTS LTD.

Rupayan prime, House #2 (1st floor), Road #5, Dhanmondi, Dhaka, 1205, Bangladesh

HASEL TARIM LTD.

Doguyaka Mah. Termesos Bulvari, 1217 Sokak Begonya Park 1 Sitesi B/2, Muratpasa, Antalya, Turkey

PREMIER TECH CHRONOS LTD.

93 Moo 9, Bangna-Trad Km.19 Rd., A. Bangplee, Bangchalong, Samutprakarn, 10540, Thailand

TIANJIN HUANONG SEEDS CO., LTD.

Xinmao Industrial Park, No. 1 Yucheng Road, Yangliuqing, Xiqing District, Tianjin, 300380, China

GIRIRAJ POLYMER

Plot No. 9, Gali No. 13, Railway Road, Samaypur Badli, Delhi, 110042 India

ZHENGZHOU HARVEST SEED CO., LTD.

Room 2706, Wanda Center. Huayuan Road and the Nongke Road, Jinshui District, Zhengzhou City, 450000, Henan Province, China

GUANG ZHOU YA SHU GARDEN SEEDS CO., LTD.

Room 1906, Yinhui Building, No. 117 Longyi Road, Tianhe District, Guangzhou, 510635, China

SHENZHEN SEED CHAMBER OF COMMERCE

F/3, Nongyekeji Tower, No. 1085, Chaguang Road, Nanshan District, Shenzhen, 518000, Guangdong, China

Corrections

On page 23 of Volume 23, Issue No. 2 (Mar/April 2017) in our India seed report, we erroneously reported that the India Government has a policy to "discourage migration to rural areas" whereas the policy is to discourage migration to "urban areas". The error is regretted.



ASIAN SEED MAGAZINE ADVERTISING

Asian Seed is the official bi-monthly publication of the Asia and Pacific Seed Association (APSA). It contains in-depth features and articles on the seed industry, including research and development, seed production, processing, marketing, IPR, phytosanitary issues, and general industry highlights. The magazine is distributed to over 65 countries with a pass-on readership of over 4,000.

Bonus distribution at the ISF Congress, Asian Seed Congress and all major seed-related events.

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Full page - right 210 x 297 mm (+5mm bleed)	1,800	2,125	10,013	18,913
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Full spread 420 x 297 mm (+5mm bleed)	2,900	3,400	16,110	30,430
Half page - right 210 x 148 mm (+5mm bleed)	1,020	1,188	5,659	10,690
Half page - left 210 x 148 mm (+5mm bleed)	920	1,088	5,120	9,670
Quarter page - bottom right 105 x 148 mm (+5mm bleed)	550	600	3,015	5,695
Quarter page - bottom left 105 x 148 mm (+5mm bleed)	500	600	2,790	5,270
Inside Back Cover 210 x 297 mm (+5mm bleed)	2,040	2,500	11,430	21,590
Back Cover 210 x 297 mm (+5mm bleed)	2,900	3,400	16,110	30,430

ARTWORK SPECIFICATIONS

Colour:
CMYK - No RGB or
spot colours

Bleed size:
5mm on four sides
without crop marks

Safety:
All graphics must be
a minimum of 10 mm from
trim on all four sides

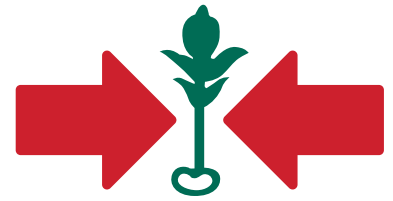
Formats:
Press-ready PDF generated
through Illustrator/InDesign,
high resolution (300dpi) or
JPEG/TIF (300dpi)

Magazine trim size:
210 x 297 mm

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