

ASIAN SEED

THE OFFICIAL PUBLICATION OF THE ASIA & PACIFIC SEED ASSOCIATION

India & Thailand Reports

Ag reinforcement,
seed trade stats

ASRT 2 & Climate Change Breeding

Solanaceous crop
research meeting

EBA Report

Seed regulatory
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Seed for Thought

APSA's Founding
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ASIAN SEED

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ASRT 2 Field Day by Steven W. Layne



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The Spirit of APSA

It has been a very interesting and busy couple of months for APSA. Accordingly, we've prepared an exciting edition of *Asian Seed* here with lots of useful and interesting information to report.

Be sure to absorb all the important updates we've got lined up for you in this edition too. Whether it's finding out about the latest seed trade trends in India and Thailand (pp. 12-19), or learning about why Korea and the Philippines topped the World Bank's Enabling Business Agriculture Asia list for seed regulation (pp. 30-31), we think you'll find it all very interesting.

I'd especially like to encourage you to read "Seed for Thought" (pp. 32-33), which was contributed by APSA's founder, Mogens Lemonious. Though APSA was officially founded with our Foundation Meeting in 1994, the story of our association goes back a fair bit further, as Mogens shares in his own words. His memoirs provide a sort of looking glass to the early days, when so much heart and soul was put into what would eventually form the foundations of APSA today.

It has been over 20 years since Mogens and his fellow APSA pioneers started the organisation, but the essence, mission and spirit of APSA remain constant in 2017. The successful Asian Solanaceous Round Table 2 (ASRT2) event (see pp. 21-24 for coverage) at the end of February was a testament to this.

The APSA Secretariat has in fact received a lot of positive feedback from this event. Over 160 breeders, scientists, pathologists and entrepreneurs, representing 12 countries, and from both the public and private sectors, gathered in Bangkok for the ASRT2. Over the course of three days, the participants engaged in progressive and productive discourse, identifying and addressing the main challenges breeders are facing today.

As the *Asian Seed* coverage on pages 25-28 highlight, there are many emerging challenges that all plant breeders are facing today as a result of climate change, encompassing extreme temperature fluctuations, unseasonable weather, shifting drought-flood cycles, and evolving pest and pathogen threats. Fortunately, we have new emerging technologies, enhanced communication methods, new tools and scientific breakthroughs to assist us in our efforts to overcome these challenges.

The world has certainly changed a lot since APSA was formed in 1994. Since that time, APSA has matured and evolved to become a powerful trading platform for its members. It is clear that we have managed to exceed the initial goals and dreams of our founders. Our continued growth and success is a result of all the care that was taken to initially establish APSA. That care still exists



Brenda Dossey, APSA President

today with our goal to build on past successes and forge a future for both seed companies and seed industries within the region.

On a related note regarding changes since 1994, International Women's Day passed recently (8 March). Its origins hail back to 1909, but it was not proclaimed internationally until the United Nations formalised the day in 1975, which was declared as the International Year of Women. It goes without saying that the seed industry relies on the hard work, dedication, intelligence and skills of many women around the world. We have been seed gatherers since there was seed gathering, and now we are engaged in every other part of the seed industry. We sell seed, package seed, test seed, develop seed policy, do plant breeding, all manner of things.

It is my great pleasure to announce that this year, *Asian Seed* plans to showcase and benchmark the achievements and empowering stories of women in the seed industry with a new "Women In Seed" column. As a woman in seed, I would like to invite all of our APSA members to send in photos and stories of influential and inspirational women in their seed-related organisations. Please drop an email to the APSA Secretariat and they will be more than happy to assist you.

Happy reading! 📖

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Creating Tomorrow Today

Together We Grow Stronger

While it has been a busy past few months for the APSA secretariat, I am pleased with the progress and successes that have transpired.

Members are completing their profiles on APSA's new website platform. They are enjoying the online membership directory and are actively utilising it to find new business opportunities and customers for their products.

If you have yet to login for the first time, please contact our Membership Officer, Bobbie, or our Business Development Officer, Suchada, for assistance.

Meanwhile, the Asian Solanaceous Round Table 2 (ASRT2) took place from 23-25 February and was a fantastic success. Thanks go to the tireless efforts of our Events Officer, Jim, and the programme coordination of our Technical Director, Dr. Dadlani. Over 150 plant breeders and scientists met in Bangkok for two days of presentations and breakout sessions which culminated with a third day field trip to Kamphaeng Saen Campus of Kasetsart University to view field trials prepared by KU and the World Vegetable Centre.

Speaking of the World Vegetable Centre, more and more members

have been signing up for the APSA WorldVeg Consortium. More details on this special benefit for APSA members can be found on our website.

The special interest groups and standing committees of APSA have all conducted their first meetings under the coordination of Dr. Dadlani. They have also set their meeting schedules for the year, planning some great activities such as study tours, webinars and expert consultations for our members in 2017. If members would like to join any of our SIGs or SCs, please see the activities section of our website for committee meeting minutes and meeting dates.

The secretariat is now collectively focusing on Asian Seed Congress 2017, with plans to visit the Philippines later this month for our final organisational inspection. We also expect to open registration early, so please do look forward to any upcoming announcements.

You may have noticed increased communications coming from our office, please be sure to read through our newsletters carefully so that you do not miss any important announcements from our Communications Officer, Steven.



Heidi Gallant, APSA Executive Director


Steven has also put together another excellent magazine, keeping with our theme this year, "Plant Breeding for Climate Change". Our communications department is always eager to hear from members, so please do not hesitate to contact Steven with any feedback, new information or related stories.

As we move into the second quarter of 2017, we are reminded of APSA's mantra, "Growing Stronger Together". Organisations join APSA to take advantage of our fantastic network of seed companies, government agencies and seed associations. The diversity of our membership, being unique to APSA, allows us to collectively strengthen each other through joint efforts and communication about all things seed.

In closing, I would like to thank our most active APSA members for the time they volunteer to serve our association each month. Without your efforts and expertise, APSA would be unable to meet its objectives. Your attitudes and selflessness mirror our Secretariat team building slogan "There is No 'I', in APSA". On behalf of us here at APSA, and of your fellow members, we thank you. 🙏





ThaSTA's GAM on Mar 10: (from left) Chairerg Sagwansupyakorn (APSA President: 2009-2010), Manas Charavanond (APSA President: 1997-1998), Heidi Gallant (APSA Executive Director), Ms. Vanida Angsuphan (past APSA EC member), Vinich Chuanchai (APSA President: 2003-2004) and Wichai Laocharoenpornkul (current APSA EC member).


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Thai Seed Trade Association holds 15th GAM



A lot of fun, food, drink and song was enjoyed on 10 March at the General Assembly Meeting of the Thai Seed Trade Association, held this year at the Ayutthaya Golf Club. During the day, the association staged its annual golf fundraising tournament. APSA's team, comprising APSA EC Member Wichai Laocharoenpornkul (East-West Seed Thailand) as well as APSA Executive Director, Heidi Gallant, and her husband, Alan Gallant, managed to finish all 18 holes (we'll leave it at that). The evening concluded with dinner, during which ThaSTA members were updated on finances, activities and other association matters. 🌱



First International Rice Forum to be Held in China



The inaugural International Forum on Rice will be held from 11-14 April in the city of Sanya, in China's Hainan province. The event is being organised jointly by members of the public and private sectors under the theme, "Southern Propagation as World Sources, Chinese Rice for Global Food". Heading the event's organising committee is the honourable "Father of Hybrid Rice", Yuan Longping, along with fellow academicians from the Chinese Academy of Engineering, including Wan Jianmin, Liu Xu, Zhu Yingguo, Li Jiayang, Song Bao-an, Zhang Hongcheng,

Chen Wen-fu, Luo Xiwen and Xie Hua-an. Planned to be held at the Beauty Crown Tree Hotel, the event will look to bring together rice breeders from over 30 countries, in addition to policy experts, reps of major enterprises and industry monitors, who will be invited to give keynote speeches in different sessions. In addition to an exhibition aimed at 500 guests, the event will showcase new varieties, technologies and breeding breakthroughs, while also planning for the establishment of an international rice industry union. 🌱

Australian Solanaceous Crop Quarantine



The Perth metropolitan area has been declared an agricultural quarantine zone until the end of June following the widespread detection of the destructive "tomato potato psyllid" plant pest. Following earlier reports of detecting the pests on Perth crops, more cases this week were reported at commercial

and backyard vegetable production sites. The infestation is the first of its kind in West Australia. The pest was detected in New Zealand around a decade ago, and it has been estimated that the pest has since cost crop managers more than NZ\$60 million a year to keep it under control. 🌱

Tokyo Government to Assist Farmers in IP Registration to Protect Japanese Seeds



In a push to increase Japan's agriculture exports to 1 trillion yen (about US\$8.78 billion), up from about 750 billion yen (\$6.5 billion) at present, the Government of Tokyo has announced measures to assist Japanese farmers in registering Intellectual Property Rights to enable legal protection abroad. Registration of a new

seed or seedling variety reportedly costs between 1 and 2 million yen (approx. \$8,700-\$17,400), which the Tokyo Government will foot for certain eligible products while advising and assisting farmers with paperwork. The initiative follows reports of copycat Japanese products thought to be derived from Japanese seeds. 🌱



Photo by Carl Davies, CSIRO



A 17% rise in FAO's Food Price Index could be attributed to a 55% spike in the Sugar Price Index.

Sugar Volatility, Dairy Demand Drives Surging Food Prices: FAO Report

Surging demand for butter-fat and sugar in the face of output shortfalls were the main factors behind food prices rising by more than 17% in a year, indicates a recent Food & Agriculture Organization (FAO) report.

According to a February 2017 report published in early March, the FAO Food Price Index (FFPI) – which tracks price quotations of 23 food commodities in five sub-indices of Cereals, Vegetable Oils, Dairy, Meat and Sugar – averaged 175.5 points, which represents an increase of 0.9 points (0.5%) over January 2017, and a 26 point (17.2%) spike over February 2016.

Most of the FAO sub-indices reflected significant month-on-month price increases, with the exception of vegetable oils, dropping by 7.6 points (4.1%) to 178.7 points.

The report cites price pressures in key global palm and soy oil markets for the monthly decline, but nevertheless underlines that the index had still experienced a 28-point (19%) y-o-y from February 2016, reinforcing the larger trend of rising food costs.

The largest m-o-m increase was seen in the FAO Cereal Price Index, which averaged 150.6 points in February, up 3.7 points (2.5%) from January. This has

caught many speculators by surprise, who had initially expected cereal prices to continue in a free-fall trend based on various optimistic reports about "record bumper crops". However, at the February level, the cereal index rose 1.6% above its value a year ago on the back of wheat quotations gaining 3%, the report notes.

It is widely understood in the commodities market that wheat quotations are much more strongly influenced by the supply, or lack thereof, of quality grain for human consumption, as opposed to animal feed and industrial grade grain. With planting areas in key producing countries like the US expected to be reduced this year, quotations have incentive to rise further.

As for other major cereals, the report highlights that "the increase in maize values was less significant, but strong demand kept prices firm. International rice prices firmed for the third successive month, mostly reflecting currency movements and expectations of stronger Basmati sales".

The most significant changes were seen in the FAO Price Indices for Sugar and Dairy. Sugar averaged 290.3 points, 103.2 points (55%) higher than the previous year, while Dairy averaged 194.2 points, 52 points (37%) higher than in February 2016.

To explain the rise in dairy prices, the report pointed to the surging demand for butter-fat, which it said had "caused butter and whole milk powder prices to increase by substantially more than those of skimmed milk powder and cheese."

As for the ever-volatile trade of sugar, prices remain "sensitive to changing prospects for sugar output in the main producing countries, notably in Brazil, the world's largest sugar producer and exporter, where protracted supply tightness continued to prevail," the report continued. "Expected production shortfalls in India and in Thailand, the world's second largest sugar exporter, also provided some support to prices. Reports of higher expected production in the EU, on expanding planted beet area, and China, limited the month-on-month gain."

On meat price trends, the FAO underlines rising prices of bovine and ovine (cattle and sheep) meat, compared to more stable poultry and pig meat prices.

"In Australia, quotations climbed as herd rebuilding reduced availability of bovine meat. Meanwhile, the ending of the seasonal slaughter peak for ovine meat in Oceania impinged on supply and triggered a price increase," the report concluded. 🌱

East-West Celebrates 35th Year with New Range and Scholarships

In celebration of its 35th anniversary, leading vegetable seed company East-West Seed is offering 35 agriculture degree scholarships to the children of farmers across 12 countries and has launched a new range of indigenous seed varieties designed for non-expert farmers in Indonesia, the Philippines and Thailand.

The new, high-quality seeds include easy-to-grow varieties and come with supplemental information to advise growers on how best to grow them to ensure optimal yields.

In the first year of launch, the firm plans to introduce 115 varieties to the market, including solanaceous (tomato, hot pepper, eggplant), cucurbits (cucumber, pumpkin, bitter melon) and leafy (kangkong, chaisim, pakchoi) crops.

The new range also includes indigenous seed varieties, enabling smallholder farmers to continue cultivating important traditional crops, for which there were no high-quality

commercial seeds available previously. In Thailand, for example, varieties offered include wing bean, rat tail radish, pea eggplant, leaf mustard and basella.

"These offerings are a continuation of our commitment to Thai farmers", said Wichai Laocharoenpornkul, General Manager of East-West Seed Thailand and Executive Committee member of APSA. "Go Grow gives non-expert farmers quality seeds and the knowledge they need to succeed when cultivating a new vegetable for the first time. Meanwhile, the indigenous crops we've introduced into our range of vegetable seed products will encourage farmers to continue growing native vegetables which form part of an important culinary, nutritional and cultural heritage in Thailand."

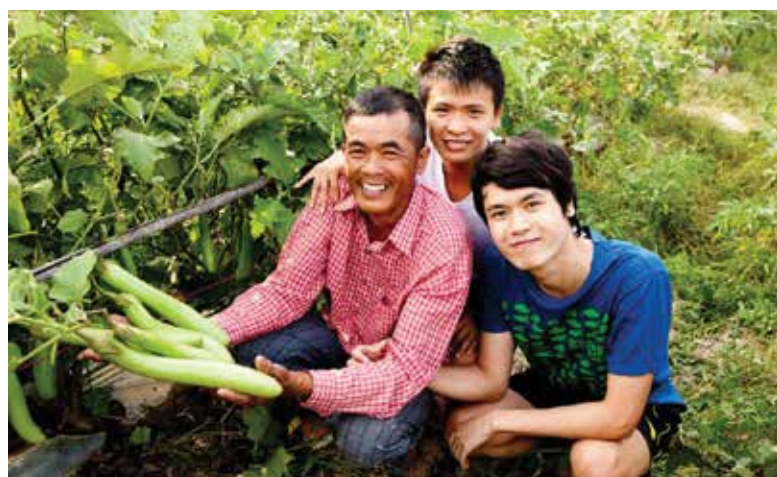
In addition to non-expert farmers, the new range may also be ideal for professional farmers with expertise in other crops who want to try their hand at a new crop, but have limited knowledge on the required cultivation techniques.



A card that comes with the seeds includes information on cultivation (sowing, spacing, watering, fertilising, protection, harvesting calendar and a graphic representation of the planting bed and trellising), and a QR code linking smartphone-equipped growers to an online Plant Doctor service, which helps farmers manage issues with pests and disease, if they should arise, and includes nutritional information on the vegetables.

This year, East-West is celebrating its 35th anniversary with the theme "Growing Opportunities".

"Our mission over the last 35 years has been to increase the income of smallholder farmers," said Bert van der Feltz, President and CEO of East-West Seed. "Farmers are facing bigger challenges today, so we are more committed than ever to offer them the best products that are more resilient to climate change, require less use of pesticides and contribute to better nutrition."



Farmer Scholars

East-West Seed is in the process of launching a scholarship programme that will enable the children of farmers to pursue undergraduate courses in agriculture. Named the "Simon Groot Scholarship Program for Agriculture", the programme will provide an opportunity for 35 students – sons and daughters of farmers – to pursue an agriculture degree in public agriculture colleges and universities.

"Agricultural education is one of the most powerful investments we can make for the future," explained Simon Groot, founder of East-West Seed. "We must encourage farmers' children to carry on their parents' legacies by equipping them with the scientific and practical knowledge to turn farming into

a thriving business and a sustainable source of livelihood for their communities."

The scholarship programme will be offered in 12 countries where the company is most active: Cambodia, Guatemala, India, Indonesia, Myanmar, Nigeria, Pakistan, the Philippines, Sri Lanka, Tanzania, Thailand and Vietnam.

In these countries, agriculture is the main source of income for a large portion of the population. However, the number of students pursuing agriculture programmes at the higher education level has been dwindling in recent years. To inspire the youth to study agriculture, East-West Seed will provide four years of scholarship as well as tuition and allowance.

"We believe that encouraging agricultural studies lays the foundation for the future of food production.

"We see this scholarship programme as a continuation of our commitment to smallholder farmers and helping them improve their livelihood and that of their children," said CEO Bert van der Feltz.

For more information on Go Grow, contact: pancharlie.vannaplerk@eastwestseed.com (Thailand); Pratama@panahmerah.id (Indonesia) and bonifacio.sauli@eastwestseed.com (Philippines); or for details about the scholarships, email: mark.relova@eastwestseed.com

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For the Future of Farmers

Underlining the growing importance of agriculture, biotechnology and food security in South and Southeast Asia, the governments of India and Thailand have both begun employing comprehensive strategies aimed at boosting farmers' incomes in the coming years.

► India

In early February, Finance Minister Arun Jaitley announced the allocation of INR586.6 billion (US\$8.8 bn) towards boosting the country's agriculture sector, which represents a 10% increase over the 2016-2017 fiscal allocation that ended on 31 March.

The capital boost will reinforce numerous schemes aimed at doubling farmers' incomes over the next five years, as initially outlined in the "Report on Doubling Farmer's Income by 2022: Farm Crisis and Farmers' Distress", published last year by the Indian Council of Food and Agriculture. In order to achieve this ambitious yet attainable objective, the ICFA estimates that through to 2022, farmers would need to realise a 15%

compounded annual income growth rate.

The latest census data states that India has more than 270 million persons employed in the agriculture sector – nearly a fifth of the country's total population and about half of its workforce.

According to figures cited in the report, the average monthly income per capita of Indian farmers was INR3,844 in 2013, more than a three-fold increase from INR1,060 in 2003.

In addition, a report from the Ministry of Statistics and Programme Implementation estimates that the average monthly income per Indian agricultural household was around INR6,426 (\$96), compared to the average monthly consumption and expenditure per agricultural household of INR6,223 (\$93).

DISCLAIMER:

Seed trade figures cited herein have been sourced and transcribed from the Agricultural & Processed Food Products Export Development Authority (Ministry of Commerce & Industry, Govt. of India) and the Thai Seed Trade Association. Please note that official data may not always reflect the full picture and that APSA will not be liable for any claims arising from the use of the data, which has been presented with the aim of highlighting general trends. Please do not hesitate to bring to our attention any errors or discrepancies in the data you may spot.

Photo by Steven Layne / APSA

Quality Seeds, Inputs & Infrastructure

Details of the Indian Government's strategy to bolster farmers were revealed by the Union Minister of Agriculture and Farmers Welfare, Shri Radha Mohan Singh, who gave the inaugural address at the Indian Seed Congress 2017 in Kolkata in February.

Minister Shri Singh explained that the Government has a policy to discourage migration to rural areas while developing industry-specific infrastructure and facilities in villages and rural areas. He went on to emphasise the promotion of value-addition production so as to expedite agro-business growth and create more employment opportunities, improving the livelihoods of farmers and their families.

Firstly, the Government will invest more in irrigation projects, under the theme, "per drop-more crop". Next, in addition to the provisioning of quality seeds and nutrients based on specific field soil profiles, more investment will be made in warehousing and cold chain facilities to prevent post-harvest crop losses. Various schemes will promote value-addition

through food processing, while an electronic trading platform will be implemented across 585 "Mandi", or National Agriculture Markets (e-NAM) countrywide. Moreover, the Government will look to offer a new, affordable crop insurance scheme to mitigate climate risks while promoting ancillary activities such as poultry, beekeeping and fisheries.

According to Minister Shri Singh, the availability and adoption of quality, certified seeds in India has increased significantly thanks to policy initiatives of the Government. Namely, the number of quality, certified seeds available to farmers rose from less than 40 lakh quintal (400,000 metric tonnes) during the 1960s, up to 370 lakh quintal (3.7 million metric tonnes) in 2015-16.

Shri Singh added that the Department of Agriculture, Cooperation & Farmers Welfare has asked State Governments to prepare variety-wise seed rolling plants to meet year-wise, and season-wise requirements of quality seeds. These plants will fulfil the dual-purpose



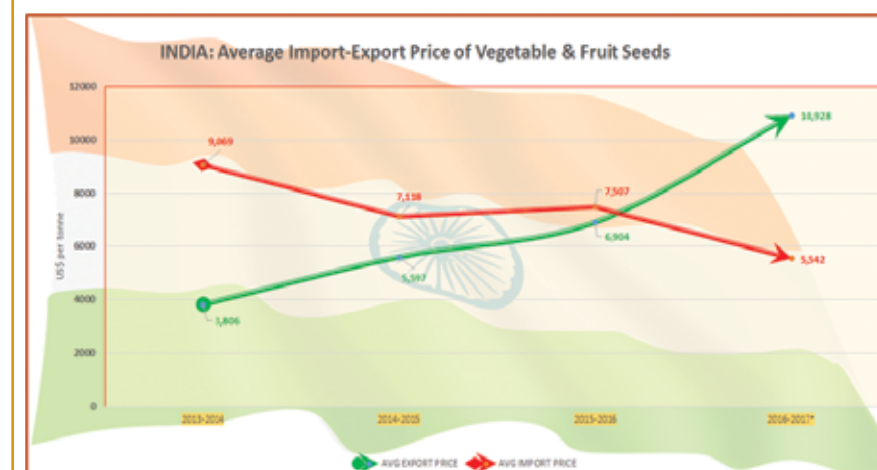
of improving seed and variety replacement rates, while ensuring sustainable agricultural production and productivity.

The Union Agriculture Minister further underlined the rapid growth of the Indian seed sector, especially in respect to the market for hybrid seeds of vegetables, maize, paddy, pearl millet and cotton. He stated that India has great potential to increase its

capacity as a prominent supplier of quality seeds to international markets, emphasising the Indian advantage of having relatively lower production costs when compared to other countries.

According to the NSAI, the Indian hybrid seed sector currently turns over about INR billion 160-180, or about US\$2.4 billion to \$2.7 billion by today's exchange rate.

India Vegetable & Fruit Seed Export & Import Trends



Four years ago, the average value of fruit and vegetable seeds being imported into India (\$9,069 per tonne) was significantly higher than that of exported seeds (\$3,806). However, figures published by the DGCIS now indicate a sharp reversal trend towards higher-value Indian seed for export, compared to lower-value imported seeds.

According to Indian port records covering the first eight months of the 2016-2017 fiscal year (April-November 2016), the average export value per tonne of seed rose to \$10,928, while the average value for imports had fallen to \$5,542.

Nonetheless, India still had a significant seed trade deficit equating to about \$23 million, derived from exports of 4,631 tonnes of seed worth \$50.6 million, deducted from 13,416 tonnes of imported seed worth \$74 million.

The top 10 countries (see chart on p. 14) importing Indian seed accounted for 70% of all Indian fruit and vegetable seed exports in terms of volume, and about 78% by value. Bangladesh, Japan, Kenya, the Netherlands, Pakistan and the US have consistently been top importers of Indian seed over the past four years. And while countries in South Asia tend to import a significantly higher volume of seed from India than Western countries, the contrast in the values of traded seed is stark.

India Vegetable & Fruit Seed Exports & Imports						
			2013-2014	2014-2015	2015-2016	2016-2017*
EXPORTS	Qauntity	tonnes	17816.75	12499.32	10925.64	4631.42
	Value	million US\$	67.82	69.96	75.43	50.61
	Avg Price	\$/tonne	3806.36	5596.82	6904.00	10928.08
IMPORTS	Qauntity	tonnes	8198.19	14115.23	14328.06	13416.07
	Value	million US\$	74.35	100.47	107.57	74.35
	Avg Price	\$/tonne	9069.08	7117.56	7507.37	5541.71
	Trade Balance	million US\$	-6.53	-30.51	-32.14	-23.74
		tonnes	-9618.56	1615.91	3402.42	8784.65
April to March: * s April to Nov. 2016						

QUALITY REVERSAL: Four years ago, the average price of imported seed was higher than that of exported seed, but a new trend is emerging.

India Seed Export & Import Trends (continued)

		India's Top Fruit and Vegetable Seed Suppliers											
		Imports in US\$ Million				Imports in Tonnes				Avg Value Per KG in US\$			
		2013-14	2014-15	2015-16*	2016-2017*	2013-14	2014-15	2015-16	2016-2017*	2013-14	2014-15	2015-16	2016-2017*
1	Thailand	15.40	16.38	20.20	13.34	166.00	209.99	167.58	116.03	\$92.26	\$78.00	\$120.57	\$114.96
2	Chile	12.53	17.26	16.54	10.94	97.91	141.31	130.51	112.74	\$127.97	\$122.16	\$126.76	\$97.05
3	Egypt	7.46	16.69	14.29	12.82	5067.00	10791.00	10364.00	9184.00	\$1.47	\$1.55	\$1.38	\$1.40
4	United States	7.28	12.06	11.03	6.86	453.90	513.61	829.27	944.95	\$16.05	\$23.49	\$13.30	\$7.26
5	China P Rp	5.39	4.72	8.28	5.21	72.38	142.00	77.23	106.44	\$74.44	\$33.27	\$107.19	\$48.91
6	Chinese Taipei	4.88	6.05	5.81	3.13	9.17	10.96	12.61	5.97	\$532.85	\$551.90	\$460.45	\$525.20
7	Italy	4.14	5.43	4.27	3.63	39.58	459.62	685.93	1006.43	\$10.46	\$11.81	\$6.22	\$3.61
8	New Zealand	2.52	3.02	4.06	4.01	861.62	1085.76	1374.23	1689.63	\$2.93	\$2.78	\$2.95	\$2.38
9	Korea Republic	2.20	2.72	3.56	2.82	84.18	77.45	72.99	31.05	\$26.11	\$35.08	\$48.74	\$90.78
10	Philippines	1.55	2.54	3.05	1.05	36.78	52.33	61.90	26.17	\$42.18	\$48.49	\$49.25	\$40.21

Thailand and Chile are consistently India's top supplier of seed. *Data for 2016-2017 covers the period from April to November 2016. Source: APEDA



An APSA delegation in September 2016 toured numerous Indian farms and seed processing facilities in Raipur and Hyderabad. Photos: Steven W. Layne / APSA



Most notably, the 66 tonnes of Indian seeds exported to the US from April to November 2016 were worth \$8.5 million, or about \$125 per kilogram. This is compared to 1,873 tonnes of Indian seed exported to Bangladesh during the same period, which was valued at only \$6.4 mn, or \$3.44 per kilogram.

Exported Indian tomato seeds contributed to the highest gross value of specifically categorised seeds, with nearly 49 tonnes of the solanum species seed valued at about \$9.8 million, equivalent to about \$198 per kg. The value of 303 tonnes of onion seed exported, in contrast, was only \$2.7 mn, or about \$9 per kg.

Considerable variations in value of tomato seed by destination country should also be noted. For example, India exported a little over 5 tonnes of tomato seed to the US at the average value of \$417 per kg, compared to the 2.5 tonnes of tomato seed it exported to Bangladesh worth \$205 per kg.

Chile, Egypt, Thailand and the US have consistently been India's top suppliers of fruit

		India's Top Fruit & Vegetable Seed Buyers											
		Exports US\$ Million				Exports in Tonnes				Avg Value Per KG in US\$			
		2013-14	2014-15	2015-16	2016-2017*	2013-14	2014-15	2015-16	2016-2017*	2013-14	2014-15	2015-16	2016-2017*
1	Bangladesh	6.89	9.08	11.90	6.45	4681.93	5329.58	5623.77	1873.89	\$1.47	\$1.70	\$2.12	\$3.44
2	Pakistan	11.18	10.73	11.40	6.89	6421.43	4012.93	1690.11	542.32	\$1.74	\$2.67	\$6.74	\$12.70
3	United States	7.16	8.87	10.82	8.53	173.65	85.03	115.58	66.44	\$41.22	\$104.30	\$93.59	\$128.39
4	Netherland	5.88	6.07	8.48	6.84	105.54	82.16	119.26	147.01	\$55.71	\$73.86	\$71.08	\$46.53
5	Japan	3.43	3.57	3.51	2.62	187.99	194.86	169.02	118.29	\$18.24	\$18.33	\$20.78	\$22.15
6	Kenya	1.72	2.47	2.67	2.36	57.12	48.47	117.52	132.87	\$30.11	\$51.00	\$22.68	\$17.76
7	Korea Republic	1.33	1.72	2.65	1.92	263.91	110.29	94.91	71.58	\$5.03	\$15.58	\$27.90	\$26.82
8	Thailand	3.75	3.37	2.53	1.92	48.07	58.26	116.67	68.76	\$78.00	\$57.86	\$21.65	\$27.92
9	Singapore	2.45	2.62	2.45	1.78	59.12	56.35	70.80	63.84	\$41.40	\$46.54	\$34.64	\$27.88
10	France	1.84	1.25	2.01	0.81	65.45	17.84	32.71	11.61	\$28.14	\$70.17	\$61.51	\$69.77

Compiled by APSA using data from the Agriculture and Processed Food Products Export Development Authority

Exports by Type		
Product	Quantity	US\$
Tomato	49.65	9,832,570.00
Onion	303.85	2,736,299.00
Fescue seed of forage plants	0.19	1,623,289.00
Alfalfa for sowing	89.85	1,008,193.00
Herbaceous plants for flowers	76.71	837,908.00
Pea	212.05	511,170.00
Radish	285.08	415,575.00
Cauliflower	5.13	250,101.00
Cabbage	3.96	202,434.00
Clover (trifolium spp) seed for sowing	0.33	12,924.00
Rye grass seed of forage plants	0.04	35.00
Other vegetable seeds	2,294.89	24,262,726.00
Other fruit seeds	783.43	4,325,485.00
Fruit seeds for planting or sowing	247.35	4,205,044.00
Other seed of forage plants	278.92	388,805.00
Total	4,631.43	50,612,558.00

From Apr to Nov, 2016, India exported 4,631 tonnes of seeds for sowing valued at US\$50.6 million, while importing 13,416 t of seed during the same period worth US\$74.3mn. Source: APEDA

and vegetable seeds over the past four years. Like exports, the range in the value of seeds imported into India varies greatly depending on country of origin and type of seed.

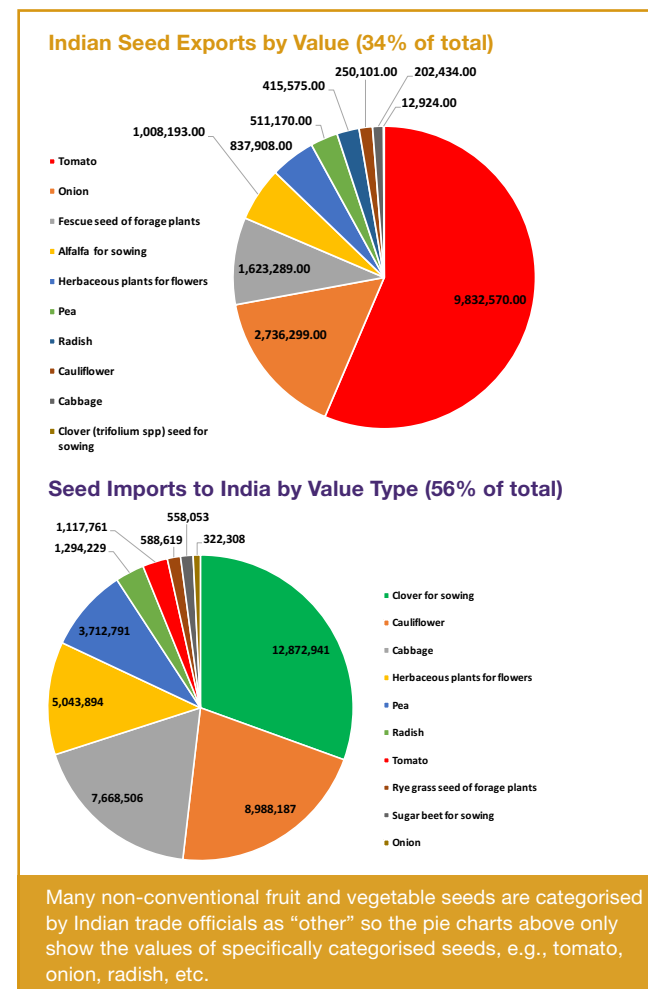
Interestingly, seeds imported to India from Chinese Taipei were significantly more valuable than seeds from all other countries, with the value of India-destined Taiwanese seed averaging \$525 per kg. Of these, 3.1 tonnes were cauliflower seeds

worth \$667,000, 1.7 tonnes were various uncategorised fruit seeds worth \$877,848 and 1,066 kg were other uncategorised vegetable seeds worth \$1.58 mn.

This is compared to Thai seeds imported into India, which posed the second highest average value at \$115 per kg. This constituted various types of uncategorised vegetable seeds (80 tonnes worth \$8.5 mn) and fruit seeds (61 tonnes worth \$4.2 mn),

in addition to tomato seeds (1.3 tonnes worth \$639,883), cabbage seeds (120 kg worth \$13,121) and cauliflower seeds (17 kg worth \$3,296).

Additionally, even though India imported the highest volume of seeds from Egypt (9,184 tonnes), the average value of the Egyptian seeds, which were entirely clovers or *Trifolium Spp* seeds, was just \$1.40 per kg. 🌱



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I&B

► Thailand 4.0: Bioeconomy

In a bid to bolster and modernise its agriculture production base over the next decade, the Government of Thailand will partner with private stakeholders to invest billions of dollars into the development of a biotechnology-reinforced agriculture economy.



Speaking at the “International Conference on Sustainable Agriculture and Bioeconomy” on 28 February at the Bangkok International Trade and Exhibition Centre, Anon Sirisaengtaksin, a consultant and former chief executive of PTT Exploration and Production, a subsidiary of the Thai state-owned PTT Group, revealed details of Thailand’s ‘Bioeconomy’ strategy.

He explained that the modernisation of agriculture is one of several key drivers of the Government’s “Thailand 4.0” economy modernisation scheme, with other drivers including the development and promotion of innovation, manufacturing, SMEs, start-ups, tourism, exports and domestic spending.

Anon went on to explain that the Government is developing biorefinery facilities in strategic locations around the country, which will look to exploit the value-addition potential of specific cash-crops. Specifically, sugarcane and cassava will serve as



Anon Sirisaengtaksin presented the Bioeconomy strategy on 28 February.

the first two pilot cash-crops to be exploited at biorefineries. Anon noted that Thailand is already a global leader in the production and export of these crops in their raw form.

The Government had initially announced in January some details of the 400-billion-baht (\$11.3 bn) scheme, of which 51 bn baht

(\$1.4 bn) had been earmarked to initiate 20 projects in the first phase to be carried out over this year and the next.

The Deputy Prime Minister, Somkid Jatusitipak, announced at a press conference on 23 January that the scheme will rely on investments from both the private and public sectors

Raising Farmers Profile

Increasing the capacity and productivity, and thus incomes, of Thai farmers in the coming years will not be without various demographic and geo-economic hurdles. Among them is a skyrocketing household debt-to-GDP ratio, which, according to the Fiscal Policy Office, had exceeded 85% in 2014. Of the country’s total household debt that year, it is estimated that more than 28% had been acquired through regulated loan channels for the purposes of engaging in agriculture, which was also cited as the reason behind around 11% of all unregulated loans.

However, the potential marginal returns from conventional agriculture hardly justify the risk. According to available figures from the Bank of Thailand, the agriculture sector’s GDP contribution in 2015 was about THB657.8 billion (about \$18.7 billion), less than

7% of the total GDP, which is insignificant considering that the price of agricultural products in the kingdom, as indicated by the Office of Agricultural Economics’ Agricultural Price Index, rose by 76% since 2005, with the indices for vegetables and fruits more than doubling at 235 and 220 points on the price index, respectively.

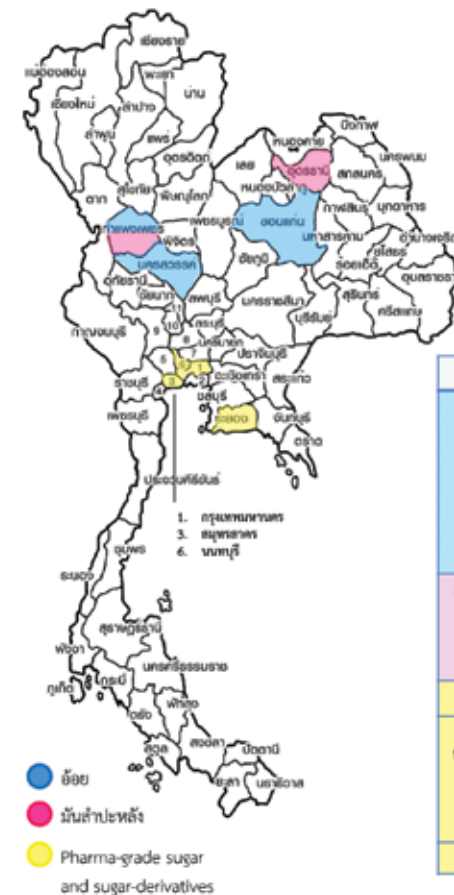
While it is estimated that resource-based agriculture provides employment for about 20 million people in 7 million households nationwide, only a small fraction of these have the security net offered through organised cooperatives. According to figures from the Cooperative Promotion Department, in 2016 there were a total of 4,088 agriculture groups active in rice, field and horticulture crops, and in fisheries and livestock, providing a living for 549,945 farmers throughout the country. Of these, 62% were males



Mechanised harvesting of sugarcane in Khon Kaen, Thailand.

and about 40% had only achieved a maximum primary-level of education, in addition to 27% who had acquired a secondary diploma or general technical certificate – with only 3% of the farmers having obtained an advanced technical diploma and just 4% having completed a university degree.

Perhaps this might explain why the average income in rural provinces remains relatively low. While the mean monthly household income in the greater Bangkok region was THB41,000 in 2015 (\$1,169), that for the agriculture-dependent North and Northeast regions was only THB18,952 and THB21,094 (\$540-\$600), respectively. In comparison, monthly household expenditure in these two regions averaged THB15,268 and THB17,032, respectively (\$435-\$485).



1st Phase – Biorefinery Sites (Feedstock = Sugarcane and Cassava)

เสนอให้ Biorefinery sites เป็นส่วนหนึ่งของ พรบ. พื้นที่เขตเศรษฐกิจพิเศษภาคตะวันออก (Eastern Economic Corridor: EEC) ตามมาตรา 3

- อยู่ในจังหวัดชลบุรี ระยอง ฉะเชิงเทรา และพื้นที่อื่นใดที่จะมีการออก พรก. เพิ่มเติม
- ดำเนินตามนิยามของ “อุตสาหกรรมเป้าหมาย” ได้แก่ เติบโตขึ้นที่เป็นมิตรต่อสิ่งแวดล้อม อุตสาหกรรมการเกษตรและแปรรูปอาหาร อุตสาหกรรมเชื้อเพลิงชีวภาพและเคมีชีวภาพ อุตสาหกรรมการแพทย์ครบวงจร และอุตสาหกรรมเทคโนโลยีขั้นสูง และอุตสาหกรรมแห่งอนาคตอื่นๆ

วัตถุประสงค์	จังหวัด	ผู้ลงทุน	ผลิตภัณฑ์/โครงการที่ลงทุน
อ้อย	1) อ. บ้านฉาง จ. ชลบุรี 2) อ. บางพลี จ. นครปฐม 3) อ. ปะนาโมธิ จ. กำแพงเพชร	1. Mitr Phol 2. PTT 3. PTTGC 4. Ueno Fine Chemical 5. Asla Star Trade 6. KTIS 7. Cristalia	1) Ethanol/Dieselohol 2) โพลีเอทิลีน High pressure co-generation 3) Lactic acid / Lactate / PLA; Succinic acid / 1,4-Butanediol; Sugarcane wax 4) สารให้ความหวานแทนน้ำตาล (food) 5) Yeast extract (food) 6) Yeast extract / Yeast probiotics (feed) 7) Soluble / Liquid feed enzyme (feed) 8) Beta-glucan (feed)
มันสำปะหลัง	1) อ. เมือง จ. อุตรดิตถ์ 2) อ. ปะนาโมธิ จ. กำแพงเพชร	1. Thai Wah 2. Cristalia	1) CBG 2) โพลีเอทิลีน High pressure co-generation 3) Lactic acid / PLA 4) กากมันสำปะหลังเป็นอาหารสัตว์ (feed) 5) Beta glucan / Yeast extract (feed)
-	กำแพงเพชร	PTTGC	Premarketing for PLA applications
Pharma-grade sugar and sugar-derivatives	1) บ้านฉาง 2) ระยอง 3) สุพรรณบุรี	1) Slam Bioscience 2) Baxter (Thailand) 3) Thai Otsuka	1) Monoclonal antibodies and Advanced vaccines 2) นวัตกรรม (nutraceuticals) 3) Beta glucan (nutraceuticals) 4) Policosanol (nutraceuticals)
-	Nationwide	-	4) Clinical research

Graphics Bank of Thailand

The Bioeconomy plan includes public-private projects to process sugarcane (blue) and cassava (pink) in several provinces, as well as other refined derivatives (yellow).

to develop capacity for processing raw agricultural materials into biofuel, bioenergy, biochemicals, animal feed, food ingredients and pharmaceuticals. As part of the initial phase (2017-2018), projects in Khon Kaen Nakhon Sawan, Kamphaeng Phet, Udon Thani, Nonthaburi, Rayong and

Samut Sakhon provinces will involve the production of biofuels (ethanol, biodiesel from cassava and sugarcane), food ingredients (yeasts, starches, probiotics), animal feed and pharmaceuticals (monoclonal antibodies, advanced vaccines and nutraceuticals). The bottom line of

the plan is that a transition from resource-based agriculture to a “knowledge-based value chain” economy could increase the GDP per capita in the agriculture sector quite significantly, up from THB48,000 (\$1,382) per capita in 2014, to as much as THB85,000 (\$2,447) per capita by 2020. 🌱

Bioeconomy: Transformation's Game Changers

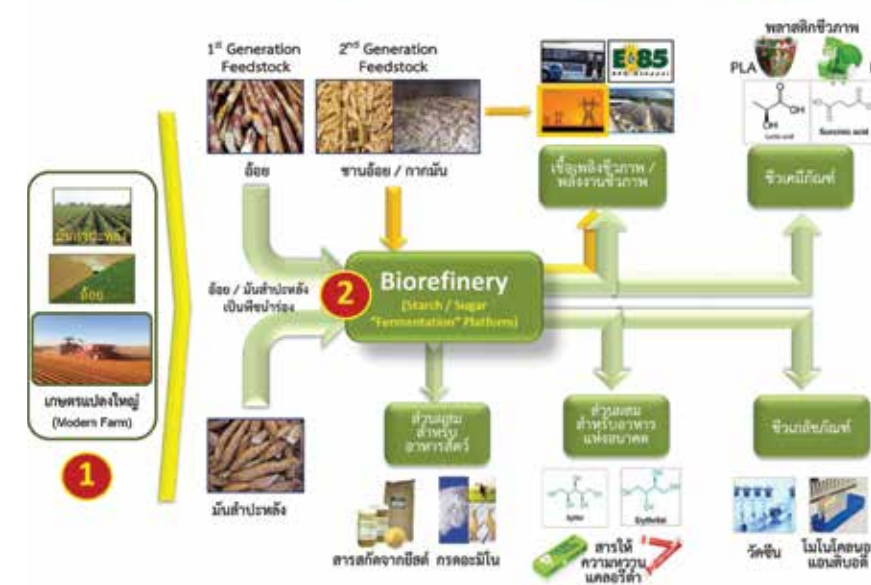


Photo by APSA

Sugarcane and cassava will serve as two pilot crops to produce various types of food, energy and medicinal products at refineries.

Sustaining Seed Supply Surplus

In addition to promoting biotechnology and value-addition chains in agriculture production, the Thai Government will also continue to promote the trade of quality seed under a strategy to develop the Kingdom into a global production hub. Here, *Asian Seed* highlights some recent seed trade trends.

According to the Thai Seed Trade Association, in 2016 the Kingdom exported a total 21,115.8 metric tonnes of seed (for sowing) to about 100 countries. This is compared to 7,636 tonnes that was imported from about 25 countries. The exports were valued at more than 5.5 billion baht (\$156.7 mn), which works out to an average of THB262.8 (\$7.49) per kg, while the imports were worth THB923 mn (\$26.3 mn), or about THB121 (\$3.45) per kg.

In terms of both value and volume, Vietnam was the top buyer of Thai seed, having imported a total of 6.7 metric tonnes worth

THB864 million (\$24.6 million), or about THB127 (\$3.62) per kg. This was followed by Myanmar, who imported 3.5 tonnes of Thai seed worth THB669 million (\$19 million) or THB190 (\$5.42) per kg.

Other top importers of Thai seed were the USA, who imported 57 t @ THB593.2 mn (\$16.9 mn); Pakistan: 3,094 t @ THB567 mn (\$16 mn); India: 167 t @ THB441.6 mn (\$12.5 mn); the Netherlands: 41.5 t @ THB387 mn (\$11 mn); Japan: 129.4 t @ THB244.8 mn (\$6.9 mn); Malaysia: 1,161 t @ THB237.8 mn (\$6.7 mn); Sri Lanka: 1,173 t @ THB234.8 mn (\$6.69 mn); China: 864.5 t

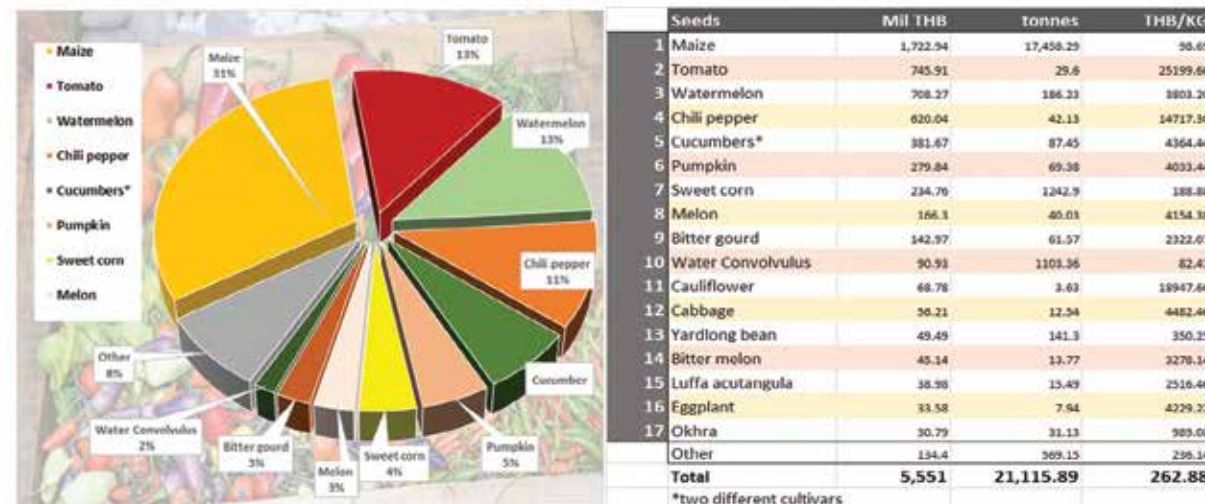
@ THB215.9 mn (\$6.1 mn); Bangladesh: 828.8 t @ THB152.7 mn (\$4.3 mn); Cambodia: 621 t @ THB117 mn (\$3.3 mn); and Israel: 15.3 t @ THB112.4 mn or (\$3.2).

In terms of gross value, the top supplier of sowing seed to Thailand was Japan, who exported just over 45 tonnes of seed to Thailand, worth THB136 mn (\$3.8 mn). Other major suppliers of seed to Thailand were the Philippines, exporting nearly 99 t of seed worth THB93.6 mn (\$2.6 mn); New Zealand: 957 t worth THB93.5 bn; and India, who exported 354 t of seed to the Kingdom worth THB92.6 mn.



Photo by APSA

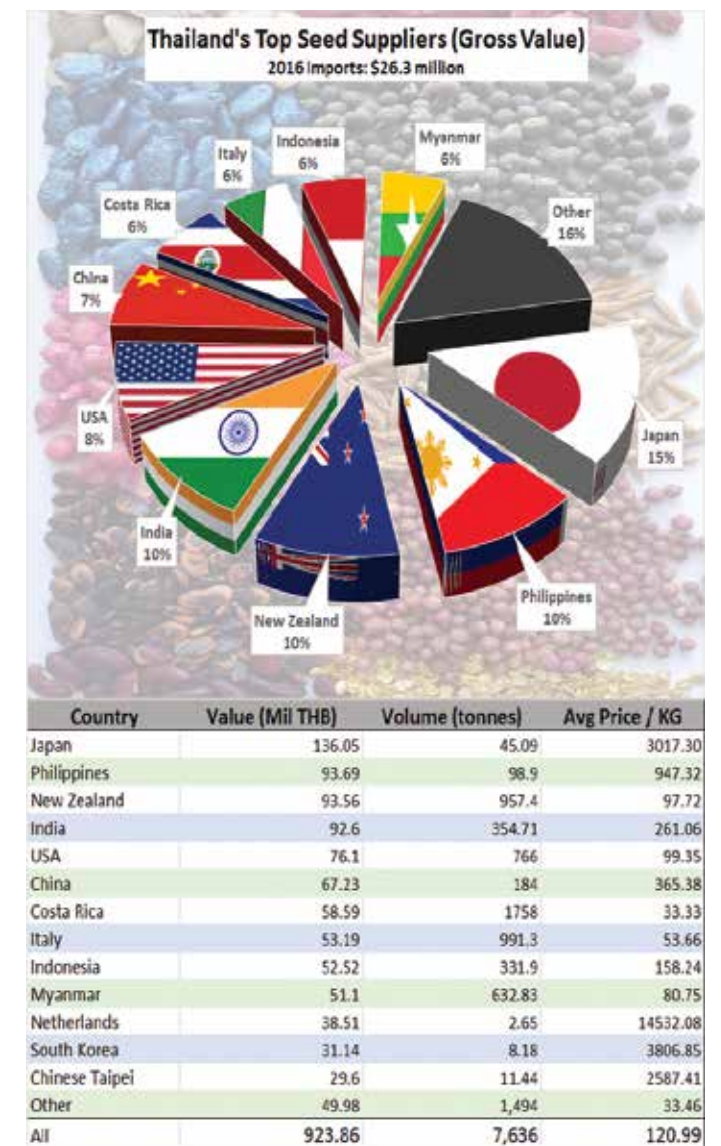
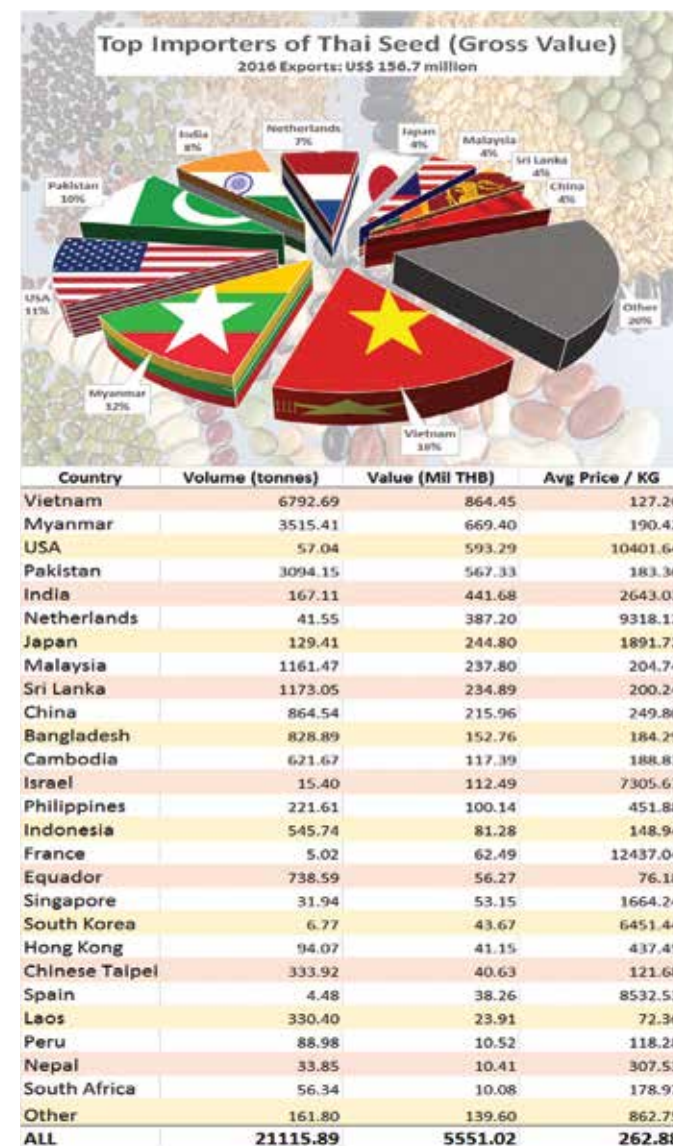
Thailand Seed Exports & Imports: 2016



Exports (above): \$157 million | Imports (below): \$26.2 million



Compiled by APSA using data from the Thai Seed Trade Association





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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ASRT 2: Strengthening Partnerships for Solanaceous Research

The second edition of the Asian Solanaceous Round Table (ASRT 2) – held in Bangkok and Nakhon Pathom, Thailand, from 23-25 February – proved a productive platform for promoting public and private partnerships, and collaborations, in advanced vegetable breeding research.

Thousands of years of breeding knowledge, experience and expertise came together in the Ruang Khao Grand Conference Hall of Kasetsart University's Faculty of Agriculture (Vachiranusorn Building) on 23 and 24 February, with breeders taking to the field on 25 February to tour a trial solanaceous crop plot at the Tropical Vegetable Research Center (TVRC) in Kasetsart University's Kamphaeng Saen campus in Nakhon Pathom.

Over the course of the two days of technical sessions, dozens of eminent

professors, breeders, researchers, pathologists, biologists and managers – from Australia, Bangladesh, China, Chinese Taipei, France, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, Myanmar, the Netherlands, the Philippines and Thailand – discoursed over a wide range of subjects related to solanaceous crop research.

Presentation topics covered everything from basic and advanced phenotype and genotype selection, screening and diagnostic tools, to field and controlled trial results, cutting-edge molecular manipulation, and mutation methods, in addition to market status updates for India, Japan, Korea, Thailand and elsewhere in Asia.

Among the breeding priorities identified were for lines resistant to biotic threats, namely Chilli Veinal Mottle (ChVMV), Cucumber Mosaic Virus (CMV), leaf

curl virus (LCV) and anthracnose in peppers, as well as TOSPO resistance breeding in tomatoes – all of which continue to adversely impact crop productivity in tropical and subtropical Asian countries, resulting in considerable yield losses.

Participating members in TOSPO public-private partnership with BIOTECH Thailand were given a positive progress update about the successful mechanical inoculation of Tomato Necrotic Spot Virus, underlining a promising method for participating breeders to screen for resistance.

Breeders also showed strong interest in promising TYLCV, BW and Nematode resistant tomato lines demonstrated at TVRC, and were given a comprehensive update by Kasetsart University and the World Vegetable Center on the status of chilli anthracnose in Asia.

Meeting the Mark

Having played a supporting role in the organisation of the initial ASRT in Bangalore, India, in 2014, APSA took the lead in organising the follow-up meeting, supported by Kasetsart University. Heading the APSA Steering Committee for the meetings was Dr. Narendra Singh, who has been the driving force behind ASRT, something which he had initially conceptualised with several other colleagues.

“Initially, we had envisioned an Asia-focused event similar to the Tomato Breeders’ Roundtable. In response to feedback, we ultimately decided to include other important vegetables in the Solanaceous family, namely chilli and eggplant, which share similar breeding challenges,” Dr. Singh explained. “Having learned a lot from the first event, we were able to improve on several aspects for the second meeting. The topics this time were very focused and addressed the issues we as researchers and farmers

are facing. Speakers were all of a high calibre and were all willing to share their work, which was conducive to productive and progressive discussions,” added Dr. Singh, who himself has accumulated more than 25 years of domain knowledge and skills in plant breeding, genetics and crop management, and currently serves as Director of Research and Development (Asia) at HM Clause in Thailand.

Dr. Singh also spoke on the addition of a field trip this year being a wise move.

“The field day really augmented the overall experience, giving meaning to what was discussed in the technical sessions, enabling breeders to be able to go out and see actual results in the

field, which greatly increased the potential for further interaction, networking and collaboration.”

However, Dr. Singh stressed that there is much work to be done moving forward.



Dr. Narendra Singh

“We still have basic research challenges to overcome. Namely, identifying new traits in respect to disease resistance, biotic stresses

and innovative horticultural traits. Too few are engaged in this type of basic yet critical research, which requires lots of investment, time and patience,” he explained. “Many small or medium companies can afford to do so, though most of the basic research is done by public institutes. Still, there remains a huge gap, and the ASRT has proved an effective platform for bridging this gap, bringing together the

resources of the private and public sectors for the benefit of small, medium and large companies. Coming together will help to address real issues faced in Asia, avoid duplication of work, and ensure that we can remain focused on the issues, while better utilising resources and expenses.”

In addition to promoting public participation and partnerships, Dr. Singh revealed that ASRT 2 also looked to develop partnership potential between and among the private sectors.

While public collaboration has been progressive in Thailand and Chinese Taipei through organisations like APSA, BIOTEC Thailand and World Vegetable Centre, Dr. Singh explained that collaborations with public institutions in other major countries, such as India and China, will prove more challenging due to various restrictions on seed trade policies and regulations.

Challenges Ahead

Another pioneering member of the ASRT, Dr. N. Anand, Director of Research at Namdhari Seeds Pvt Ltd., Bangalore, India, sat down with *Asian Seed* to share his impressions. Actively involved in vegetable research in both the public and private sectors for the last 40 years, Dr. Anand was a key collaborator of the inaugural ASRT and chaired several sessions at ASRT 2.

Having several hybrids and varieties to his credit, Dr. Anand’s speciality is in disease resistance in solanaceous crops, especially tomatoes, and he has played an active role in APSA’s Special Interest Group on Vegetables and as a member of the association’s IPR Standing Committee.

Dr. Anand noted that organising a PPP-focused event is no easy task, outlining the difficulties in shortlisting good speakers, both domestically and from abroad, flying them in, taking care of them, and ensuring meaningful and productive meetings with clear, measurable objectives.



Dr. N. Anand

“Looking back, I can say we met our objectives. We wanted to bring in key decision makers from both the public and private sectors. We wanted good speakers from Asia and other regions. We had break-out sessions where we identified the main problems breeders face, and more importantly, ways to overcome them, prioritise and plan.”

And it was on this successful model that the success of the second ASRT was ensured.

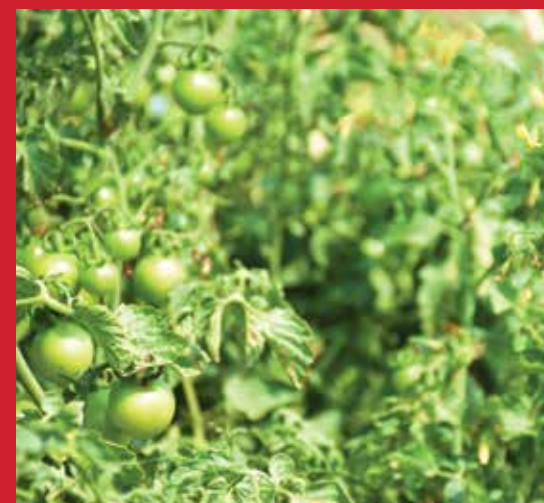
One noteworthy success Dr. Anand highlighted is the ongoing private-public

collaboration between breeders and seedsmen from APSA, and BIOTEC Thailand, in developing TOSPO resistance inoculation protocol in tomatoes, the work of which continues to benchmark progress steadily, albeit surely.

“The break-out sessions are very productive in establishing clear objectives and devising strategies on how best to approach them. With ASRT 2, there were some continuing objectives and some new ones we decided to focus on.” Dr. Anand went on to underline some challenges that need to be overcome.

“From the private sector, we’ve yet to confirm all of the public sector collaborators needed. Getting the right people on board is a major challenge moving forward.”

Dr. Anand also highlighted a proposal made at one of the break-out sessions. For APSA to facilitate public-private research collaboration as a sort of “matchmaker” between entities, done





through the management of a database and supporting communications.

“Many details need to be worked out, but such a suggestion could definitely be an effective solution to bridging the gap,” he said. “The private sector is really clear on what it wants because it is nearer to the market. What the market wants, we sell. Thus, we need to work quickly to identify public sector collaborators who are specialised in our objectives, and then the committee needs to meet and work with these players.”

In conclusion, Dr. Anand summarised what he termed as the “harmonisation point” between the public and private sectors.

“The public sector comes out with publications and follows up with speaking on what they’ve done. That’s their job. But the private sector has limitations in what they can share openly. The meeting point between the two is understood and works the way it is supposed to.”

“If you noticed, questions from the private sector to the public sector were addressed honestly and openly. This openness and mutual understanding is the reason why they – members of both the public and private sectors – take part in these kinds of events. They feel good when they are sought out to collaborate with fellow seedsmen and breeders.”

Breeding Benchmarks

In conclusion, there continues to be a strong need for more collaboration, both public-private and private-private, so as to meet increasing challenges in vegetable breeding research. While the ASRT has proved successful in bringing together key players in the region to

help meet some of these challenges, there is a lot more that can and should be done.

Moving forward, APSA is committed to supporting such productive events and activities, whether in a lead or

supporting role – not only for the benefit of Solanaceous crop breeding, but for that of all types of vegetable, ornamental, field and forage crops. Be sure to check our Events Calendar online for upcoming research collaborations and study tours. 🌱



Breeding for Climate Change

As the changing climate increasingly induces erratic and extreme weather patterns – in the form of heat waves and unseasonable, sustained dry, cold and wet spells – breeders, geneticists and pathologists are working tirelessly to better understand and exploit the genetic mechanisms behind the susceptibility, resistance and tolerance of plants to both biotic threats, such as pathogens and pests, and abiotic stresses, whether induced by extreme heat, drought, flooding and/or frost. At the recent ASRT 2 Asian Seed approached a number of notable experts in order to gain a better understanding of the challenges and strategies of effective breeding for Climate Change, presented herein.

Unpredictability of Extremes

Praveen Bhat Noojibail, Managing Director of I & B Seeds Private Limited (I & B Seeds), a joint venture between Indus Seeds and W. Atlee Burpee Company of the USA, underlined the difficulties in breeding for the unpredictable weather.

“The conditions of unpredictability, the duration, the nature of it, is difficult to replicate. It’s not like breeding for insect or disease tolerance. How can one breed for sudden temperature

changes or wide variations in growing conditions?”

“What we do is test our lines under various agroclimatic regions, across various periods, and select lines which are doing well across zones and times. We use such lines as parents for hybrids. Complaints from farmers regarding yield losses due to erratic and sudden changes in climate is a regular feature for most (if not all) seed companies.”



Mr. Praveen Bhat Noojibail

Germplasms Needed

Dr. Chee Hark Harn, Director of R&D at Nongwoo Bio, concurred that establishing an effective breeding programme for climate change is a difficult task.

“It all depends on whether or not there is a germplasm available. It is hard to find germplasms that are tolerant or resistant to abiotic stresses in the environment, on top of biotic threats such as pests and pathogens that exist in nature. Our strategy needs to incorporate open innovation and research collaboration between the public and private sectors,



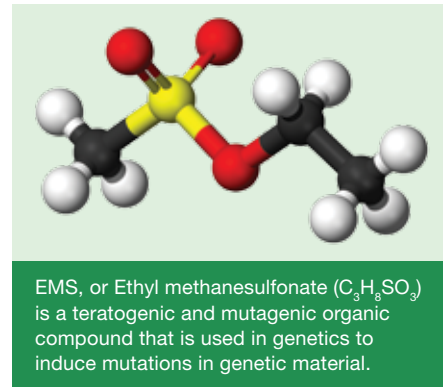
Dr. Chee Hark Harn

including the sharing of breeding knowledge, tools and germplasms.”

Dr. Harn revealed that Nongwoo Bio’s breeding programmes include heat tolerance for radish, Chinese cabbage and broccoli. However, he noted that, “They are tolerant but not resistant to heat. So if the temperature exceeds the threshold then the plant would sustain damage”.

Dr. Harn suggests that the best way to make crops tolerant to abiotic stresses is to develop new germplasms through mutation.

“You may try EMS, screening the mutants and selecting out the individual that is tolerant to the specific abiotic stress. Another way would be to develop GMOs, for which the large multi-national companies have already conducted plenty of research. They now have drought tolerant corn and soy,” he explained. “However, most Asian seed companies do not have the capabilities to implement this expensive technology. Generally, US\$120 million is required before one GMO product can go to market.”



“Globally, as well as in Korea, there is a lot of research being carried out in respect to climate change and there are tons of research papers published. This information is all important, however, we also need to have a practical approach.”

“Mutation screening such as TILLING technology (see comments from Dr. Manash Chatterjee below) should be used widely to select new germplasms for climate change. I look forward to discussing this at ASRT 3, if not sooner,” he concluded.

Non-GM Molecular Solutions: TILLING

Dr. Manash Chatterjee, Founder and Director of Indian biotechnology solution provider Bench Bio Private Limited, has worked on various public and private projects to create lines resistant to biotic and abiotic stress. With 20 years of experience in the field of plant breeding, biotechnology and functional genomics, he has been involved in collaborative research with academic institutes in India and abroad, and was also a guest speaker at the ASRT 2.

“We have an Indo-UK project on grass peas (*Lathyrus sativus*), which is a drought tolerant legume that contains about 30-35% protein. This legume is a low-input crop and is consumed by poor farmers in India and Africa. However, it carries a neurotoxin called ODAP. Despite this, farmers continue to consume it because it grows readily with low input. We are trying to create low or zero ODAP-carrying lines by TILLING to promote safe uptake of this legume.”

Other ‘climate change’ projects his firm is working on include creating drought and salt tolerant lines, fruit set without pollination, and heat tolerant varieties that indirectly avoid pollen viability issues at high temperatures, to name a few.

“The key challenge among breeders is access to new technologies to improve



Dr. Manash Chatterjee

crops for the future, which can lead to low-cost product development which will be readily accessible to consumers,” explained Dr. Chatterjee.

He went on to point out that GM technology, although currently available, is expensive, owned by big MNCs and still largely lacks public acceptance. “Gene editing is exciting new technology which everyone wants to do, but it is expensive due to patents and, outside the USA, it is treated as GMOs. So at present, companies are stuck with traditional plant breeding tools, which are slow and limited in terms of delivery of desirable traits. Although large amounts of sequence data and genes are freely available in public

databases from many crops, companies are unable to significantly benefit from this information.”

Citing imminent population growth and the need to double food production under increasingly harsh environments, climate change, low water tables and high temperatures, Dr. Chatterjee stressed that science is needed to improve crops to have better yields.

“Varieties have a life of 3-5 years, hence you have to constantly generate new varieties to replace old ones. We need a low-cost, fast-delivering breakthrough technology accessible to consumers, which will unfortunately take time.”

Anticipating Change



Dr. Dinesh Kumar Singh

Dr. Dinesh Kumar Singh, an eminent vegetable scientist and Professor of Vegetable Breeding at the G. B. Pant University of Agriculture & Technology in Pantnagar underlined drought stress as one of the most important agricultural constraints affecting growth, development and productivity of agricultural crops in India.

“There is a large amount of unexplored genetic diversity in different crops. These existing genetic resources are a good source of utilization for the improvement of abiotic stress tolerance,” stated Dr. Singh. “Therefore, the standardisation of techniques for screening genotypes of different crops, followed by the evaluation

of genotypes that enables tolerance against drought stress in field conditions, is our prime objective. In addition, we are selecting genotypes that are resistant or tolerant to biotic diseases and pests.”

“Since the climate is changing, the behaviour of genotypes, pests and diseases also change. Therefore, ideotype crop breeding for heat tolerance, as well as insect and pest resistance, has been initiated, particularly in cucurbits and solanaceous vegetable crops. Polyhouse technology is developing very fast in India. Our farmers and scientists are both ready to cope with adverse environmental conditions,” he concluded.

Suppressing Susceptibility

Dr. V. Muniyappa, who works as a Consultant with United Genetics India Pvt. Ltd, which operates out of Karnataka, echoed Dr. Singh about the serious impacts that warming and drought have brought to Southern India.

“We have witnessed Tomato Leaf Curl Virus (ToLCV) epidemics in Karnataka due to increased whitefly (*Bemisia tabaci*) populations. A decade back there was a distinct pattern, with infections higher in the summer and very low in the winter months,” said Dr. Muniyappa. “However, in recent years we have observed higher infection rates, even in the winter, though

not equivalent to the summer. This is due to the changes in weather and particularly to the temperature. Production is definitely affected and market prices have subsequently increased.”

In response, United Genetics has produced a number of tomato hybrids that are tolerant and/or resistant to ToLCV. These hybrids (in particular 10T101, 12T157, 6038,) are marketed all over India.

“Although a number of tolerant/resistant lines and hybrids are available for cultivation, due to the high diversity of tomato begomoviruses and whitefly vectors,



Dr. V. Muniyappa

the hybrids might become susceptible. Therefore, the best option is to produce hybrids that possess both virus and vector resistance.”

Climatized Pest Plant Profiles



Dr. Ben Vosman

Threats from climate-evolving pest patterns are not only limited to Southern India, as they have also come to the attention of scientists further up in the Northern Hemisphere, revealed Dr. Ben Vosman, a Senior Researcher and Group Leader for “Non-host and Insect Resistance” studies at the Plant Breeding Laboratory of Wageningen University and Research.

Asian Seed spoke with Dr. Vosman, who presented at the ASRT 2 on his work at WRU, about his various fields of research, which includes germplasm evaluation for novel resistance traits, primarily towards

sucking insects, with an emphasis on aphids, thrips and whiteflies.

“We have been dealing with more recent pests in the Netherlands, like the cabbage whitefly, which may have increased its living area as a result of the changing climate,” explained Dr. Vosman, who himself has been observing the effects of climate change on pests, and ultimately plants, for several years.

A 2014 paper he co-authored with WRU Associate, Colette Broekgaarden, and Jeremy Pritchard of the University of Birmingham, UK, highlights important influences of extreme weather on pest and plant development. Entitled, “Effects of Climate Change on Plant–Insect Interactions and Prospects for Resistance Breeding Using Genetic Resources”, their research concluded that “Climate change can have profound effects on plant–insect interactions, potentially disturbing interactions directly and indirectly. It can change population development and distribution patterns of the pest as well as of its natural enemies.”

In addition to high temperatures, other key climate change components that can influence pest-plant interactions include cold

tolerance and diapause, which refers to the suspension of development [of insects] in response to regular periods of cold.

In other words, fluctuations in both high and low temperature extremes – abiotic stresses – can directly and indirectly influence the development, or stunting of, herbivorous pest populations and thus their potential impact on crop production.

Dr. Vosman went on to stress the importance of developing an increasingly detailed understanding of the mechanisms of resistance and susceptibility in crops, and believes that the key to effectively addressing climate-induced pests and related diseases does not necessarily lie in insecticides, but rather in increasing access and availability to gene banks, in addition to the utilisation of new biotechnological tools.

“There are some small programmes focused on climate change in general, but nothing focused on plant breeding. Stimulating research in the areas of abiotic and biotic stresses would help. Elucidating on the mechanisms behind instances of insect resistance will help breeders to identify the right traits and genes and alleles,” he concluded.



Dr. Ivo Rieu

Handling the Heat

Dr. Ivo Rieu, an Assistant Professor of Molecular Plant Physiology at Radboud University in the Netherlands, studies stress tolerance mechanisms in plants, focusing on problems caused by flooding and high temperature. “As a result of

ongoing global climate change, in many places, including the Asia-Pacific region, crops increasingly face these types of stresses and suffer from significant reductions in yield. In comparison to biotic resistance traits, the genetics behind tolerance of abiotic stresses is usually complex, with the tolerance depending on multiple smaller effect loci, meaning that the traits are relatively difficult to breed for,” he said.

In their search for heat tolerance reproduction in tomatoes, amongst others, Dr. Rieu and his team take two steps to tackle these problems. Firstly, they study the traits in climate-controlled, disease and pest-free in-door growth chambers. The greatly reduced environmental “noise”, relative to field cultivation, makes it much easier to detect changes in tolerance levels. Secondly, instead of only looking at final tomato fruit production, the team invests in dissecting the underlying sub-traits. Such sub-traits are expected to have a more simple genetic make-up, which makes it easier to detect heritable

variations in tolerance level and identify the responsible loci and good markers.

In the case of tomatoes, the group found that pollen number, pollen quality, stigma position and female fertility all contributed to reproductive heat tolerance. Strong QTLs for several of these sub-traits were also identified. Dr. Rieu is now moving back to field conditions and first trials have already proven promising, reflecting the team’s experience with a similar study on common bean.

Taken together, starting with controlled growth conditions and focusing on sub-traits seems to be a useful approach when aiming for increased abiotic stress tolerance. On top of this, Dr. Rieu stressed that close contact between researchers and breeding companies is essential to align the various efforts. An important new insight he gained at ASRT2 was that breeders in the AP region differentiate between dry and humid heat. This aspect will thus need to be taken into account in future research, he concluded.



Climate Clever Smart Seeds

Facing climate havoc in the form of both extreme drought and flooding in recent years, breeders throughout Southeast Asia have made notable progress in responding to emerging weather and climate threats.

Breeding priorities at East-West Indonesia, for example, are in the selection of lines that have wider climatic adaptation, not only for dry and hot conditions, but increasingly for wet and arid conditions.

Asep Harpenas, R&D Director, told *Asian Seed*, “The need has increased to breed for resistance to bacterial and fungal diseases, and we are now broadening our crop focus to include beans, potatoes and bananas, so as to better address food security challenges”. Mr. Harpenas further explained that East-West Seed Indonesia

is actively collaborating with various public and private organisations in a programme that will provide climate-wise seeds and advanced weather intel to farmers through smartphone apps and SMS services.

According to a description by Twente University of the recently formed “SMARTseeds” consortium, climate-wise seed and information services are supplied by East-West Indonesia to 100,000 chilli, tomato and cucumber smallholder farmers in 14 regencies across three provinces, where vegetable farming has been highly affected by changes in climate, weather patterns, availability of water, and changes in pest and disease profiles. The farmers are advised on devising climate-wise planting strategies based on advanced ICT, agriculture and climate intel, collaborated

through numerous Indonesian and Dutch partners who supply everything from satellite image processing, weather and seasonal forecasts, to info on fertilisers and pesticides, and soil and farm profiles.

Mr. Harpenas concluded that the main challenge in the region is knowing and understanding the basic problems, including disease identification.

“Germplasms are needed and the high costs of advanced research is also restrictive. Mutual cooperation and better communication and coordination is also required between public and private sectors. Moreover, key decision and policy makers should help increase awareness of the problems by providing more facts to the public.”



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Korea, the Philippines Top Asia List for Seed Regulation: World Bank Report

The Republic of Korea and the Philippines have topped the list of 16 Asian countries, ranked amongst 62 countries globally, in the 2017 “Enabling the Business of Agriculture” report, published early this year by the World Bank.

The annual study measures and compares legal barriers for businesses operating in the agriculture sector in 62 economies, providing quantitative indicators across a number of topic areas. These include seed regulation, fertiliser, machinery, finance, markets, transport, water, and information and communication technology (ICT). Moreover, the study includes indicators for gender (equality) and environmental sustainability.

To learn more about the Asian results – which did not include Australia, China, Iran, Japan or New Zealand – *Asian Seed* spoke with World Bank Group Private Sector Development Specialist, Jean-Philippe Lodugnon-Harding.

“Korea’s variety registration process is one of the most efficient and affordable among EBA countries,” he said, adding that it ranked 8th overall in seed category due to strong indicators of an efficient seed sector regulatory environment. “According to contributors surveyed, it takes 298 days and costs 2% income per capita to register

a new maize variety,” he added.

The seed sector indicators took into account three main factors in ranking countries. These included the time, cost and requirements to register a new seed variety; protection and licensing of plant breeder rights; and quality control of seed in the market.

Second in seed amongst surveyed Asian countries was the Philippines, who ranked 11th overall.

Mr Lodugnon-Harding revealed that, “Compared to other countries in the region, the Philippines stands out due to its strong regulatory framework for plant breeding and the low cost of the variety registration process. While it costs 1.5% income per capita to register a new maize variety in the Philippines, the cost for this procedure can reach 99% income per capita in India and up to 406% income per capita in Vietnam.”

Here’s how EBA ranked the remaining Asian countries in terms of seed sector regulation indicators:

Turkey (12th); India (21st); Thailand (32nd); Myanmar (34th); Kazakhstan (35th); Cambodia (38th); Vietnam (42nd); Malaysia (44th); Nepal (45th); Sri Lanka (46th);

Tajikistan (51st); Kyrgyz Republic (53rd); Bangladesh (54th); and Lao PDR (59th). It should be noted that some countries in the above list may have ranked quite high in other areas of agriculture business, but due to regulatory challenges, fell short in seed. For example, the report points out that the Kyrgyz Republic ranked in the top 15 for markets and machinery as a result of having “efficient processes for exporting agricultural goods and tractor registration”, but had been “placed in the bottom 10 for seed and transport due to the lack of regulations on seed quality control and trucking licenses.”

Mr Lodugnon-Harding noted that a weak regulatory environment was the reason why Lao PDR ranked the lowest of all Asian countries surveyed in the EBA.

“Lao PDR lags behind in terms of regulatory environment for the seed sector with the weakest performance among countries in the region. Particularly, the country lacks key regulations that establish quality control mechanisms such as mandatory post-control tests on certified seed and labelling requirements,” he said.

Topping the list for ease in doing seed business was the Netherlands, followed by Spain, Denmark, Italy, Poland, Romania and Kenya.

Selection of Countries



APSA delegates tour a Korean seed production facility at the recent Post Congress Study Tour.

To select the countries where EBA indicators would be relevant and useful, the team analysed the importance of the agricultural sector in all countries by looking at the contribution of agriculture to GDP and employment. The countries were grouped into five categories: Agriculture-based, Pre-transition, Transition, Urbanised and Developed.

To select the countries to be included in the pilot phase, several additional criteria were applied. For example, countries with small agricultural sectors (defined as having agriculture value added at PPP of less than US\$1 billion) were excluded unless the population employed in agriculture is more than 100,000 people.

From an initial selection of 108 countries, to select the 10 pilot countries and subsequent scale-ups to 40 and 62 countries, the team made sure that the countries represented different geographical regions and income groups.

World Bank plans to expand the EBA survey to include 80-100 countries in the near future. 🌱



The Philippines was lauded by the World Bank due to its low cost for variety registration.

Country rankings on EBA topics by economies

	SEED	FERTILISER	MACHINERY	FINANCE	MARKETS	TRANSPORT	WATER	ICT
ARGENTINA	28	53	30	52	23	56	3	31
BANGLADESH	54	33	49	23	21	45	56	37
BENIN	55	81	51	41	36	50	38	31
BOLIVIA	25	45	52	13	22	15	43	30
BOLIVIA AND PERU GOVNA	55	1	34	60	11	52	6	31
BURKINA FASO	57	36	32	41	37	12	47	59
BURUNDI	29	42	30	59	55	30	32	52
CAMBODIA	38	26	44	48	48	34	37	43
CAMEROON	58	48	37	37	47	31	44	52
CHILE	29	54	28	46	9	46	28	15
COLOMBIA	27	8	45	1	17	10	3	9
CÔTE D'IVOIRE	50	45	35	18	60	19	49	22
DENMARK	3	3	8	37	6	3	24	9
EGYPT, ARAB REP.	37	33	26	36	49	61	55	37
ETHIOPIA	42	58	25	27	35	21	34	62
GEORGIA	13	21	42	39	19	38	48	8
GHANA	48	34	38	16	54	39	30	22
GREECE	14	9	5	4	9	14	12	1
GUATEMALA	26	10	57	24	14	58	58	21
HAITI	61	58	43	54	57	42	57	43
INDIA	21	18	21	15	42	49	53	18
ITALY	4	6	11	6	4	4	10	6
JORDAN	22	17	33	62	25	22	41	22
KAZAKHSTAN	35	15	9	50	16	55	18	22
KENYA	3	43	25	10	38	16	4	12
KOREA, REP.	8	16	19	12	10	39	9	11
KYRGYZ REPUBLIC	53	19	14	8	13	56	36	43
LAO PDR	59	27	39	47	35	26	40	39
LIBERIA	62	62	60	35	62	59	61	31
MALAWI	50	44	23	20	33	41	19	50
MALAYSIA	44	50	18	28	40	54	45	22
ITALY	52	23	31	41	44	54	50	52
MEXICO	24	24	31	9	3	20	2	9
MOROCCO	20	31	17	57	24	8	8	18
MOSAMBIQUE	23	47	47	25	30	33	21	22
MYANMAR	34	38	62	81	53	51	62	37
NEPAL	45	41	36	34	28	32	52	43
NETHERLANDS	1	7	7	12	1	9	20	1
NIGER	43	11	48	36	20	36	23	43
NIGER	44	35	55	45	39	17	38	43
NIGERIA	47	37	18	22	48	43	48	37
PERU	10	32	56	2	27	3	11	15
PHILIPPINES	11	22	13	33	38	37	17	37
POLAND	5	2	1	21	7	24	13	1
ROMANIA	6	28	5	11	52	2	7	1
RUSSIAN FEDERATION	18	29	12	38	18	40	13	18
RWANDA	60	38	41	7	42	27	32	50
SENEGAL	36	80	54	41	36	36	42	37
SERBIA	19	4	2	40	8	13	14	12
SPAIN	2	5	6	3	2	1	1	1
SRI LANKA	46	36	39	58	58	48	54	39
SUDAN	40	56	27	33	67	47	58	57
TAJIKISTAN	51	49	22	55	32	6	35	56
TAJIKISTAN	17	37	40	5	56	25	22	18
THAILAND	32	16	24	29	52	53	48	31
TURKEY	12	13	8	32	29	28	81	31
UGANDA	31	40	31	31	45	18	26	22
UKRAINE	33	32	15	26	24	42	29	43
URUGUAY	9	25	56	19	16	11	25	37
VIETNAM	42	12	16	30	51	7	27	12
ZAMBIA	16	38	46	14	50	23	16	22
ZIMBABWE	15	29	20	49	42	26	31	52

Setting the Foundation

Mogens Lemonius, 77, former FAO Regional Seed Programme Manager (Asia and Pacific) and the founder of APSA.



My father was born in St. Petersburg in 1911 and came to Denmark around 1928, where he worked in agriculture for 10 years before marrying a farmer's daughter. The young couple rented an 18 ha farm, which they later bought, and my father became a Danish citizen in 1943. The two of them had three children, of which I am the eldest, born in 1939. My younger brother became a carrier officer with the Danish Army and my sister married an Austrian and settled in that country.

From the outset, I was destined for agriculture. After working three years (1955-1958) on various farms and having finished military service (1958-1961), I attended six months of formal agricultural schooling before entering the Danish Royal Veterinary and Agricultural College in the autumn of 1961.

I got my M.Sc. in Agricultural Economics in 1965 and then stayed on one more year to continue studying agricultural economics. In August 1966 I got my first job as Agricultural Adviser for the Danish Association of Large Farms.

I married in 1964. My wife (who passed away in 2012) and I had two sons and a daughter. None of them got anywhere near agriculture except when visiting their grandparents. The boys went into banking and research development, and our daughter became a skilled teacher.

I got into the seed business by coincidence. In the autumn of 1972, I was approached by the management of the Federation of Danish Seed Growers' Associations. They needed a new national advisor. I told them that I knew nothing about seed and that I did not even know that Denmark at the time was (and still is) the most

important supplier of certified grass seeds to the EU.

Members of the federation board told me that they would teach me about seed. Denmark would enter the Common Market (which later became the EU) from January 1973, and what they needed was somebody who could develop their organisation, establish efficient relationships with other players in the Danish seed industry, and set up efficient information and communication activities.

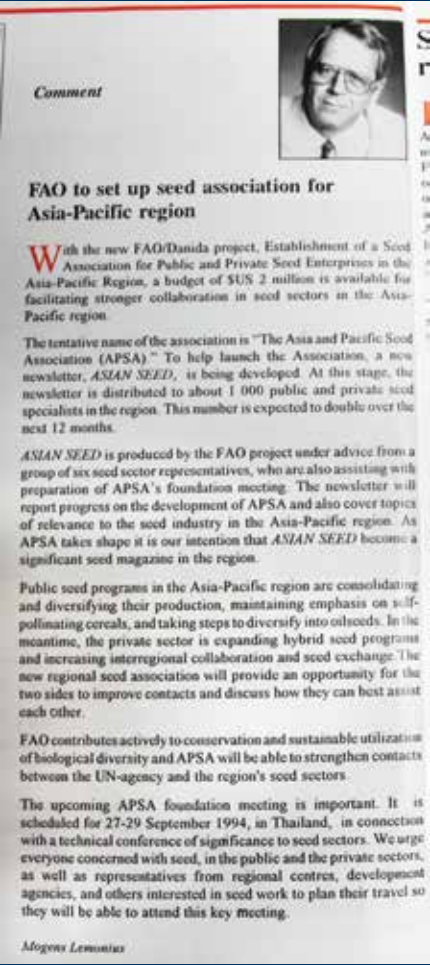
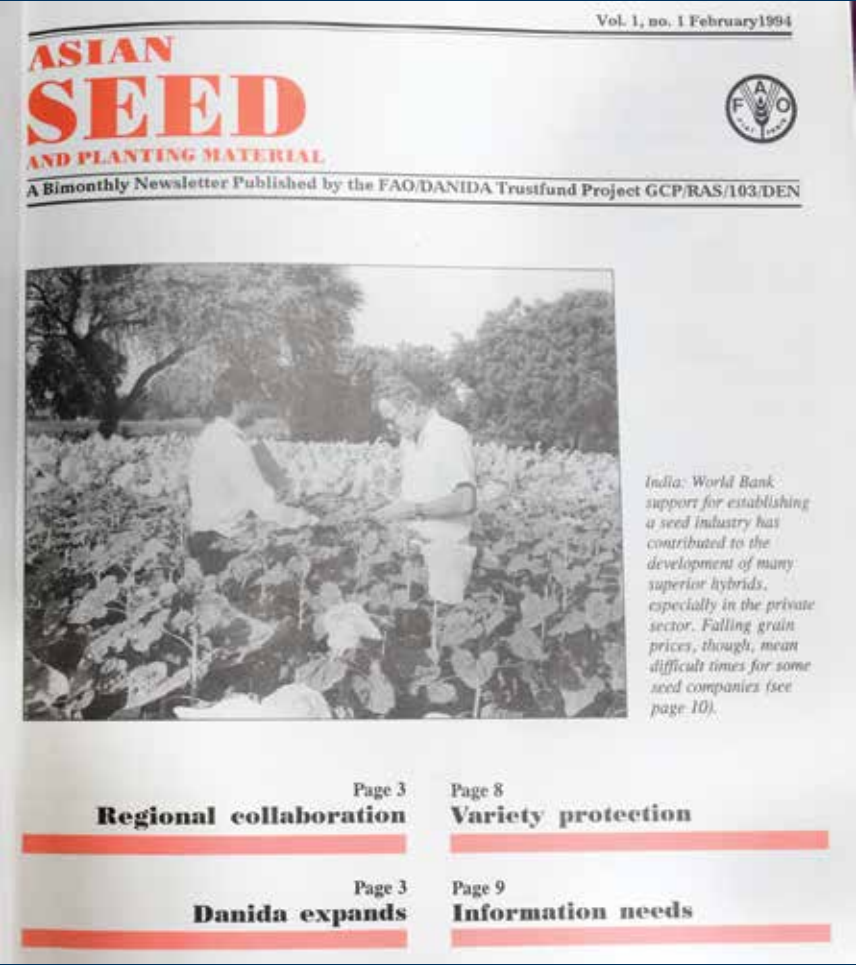
After six very educational years with the Danish Seed Federation, our family needed a change. I applied for and got a job with FAO's Seed Service as project manager, first for a national seed project in Swaziland and later for a regional seed project in Asia. Both projects were financed by the Danish Development Agency DANIDA.

We were 15 years in Asia, staying all the time in the same house in Sukhumvit, Soi 61, in Bangkok. During the first 11 years (1982-1993) I was running a conventional regional project, providing policy advice, seed centre strengthening and training to nine countries.

As this project was coming to an end, colleagues in FAO's Headquarters in Rome were suggesting that, after project completion, activities could continue within the framework of a network. I was against this. I thought we had done the job we came to do and that it was time to go somewhere else. Furthermore, I did not want to be associated with a network that would eventually fail. FAO had, at the time, more than 100 networks on its books and only a handful of them were functioning.

However, in the end we proceeded with the development of what was to become APSA. After consultation with and agreement from senior executives from public and private enterprises across Asia and the Pacific, DANIDA agreed to provide funding for a third 5-year period on the condition that after two and a half years, the FAO staff would be terminated and an organisation be put in place, registered and with a board that could

Flashback: 23 Years Ago



sign a contract with FAO. Against this, contract funding would then continue to arrive until the project ended. After that it was expected that APSA would be self-financing.

At a meeting in the FAO Regional Office in Bangkok, a preparatory committee of three executives from each of the region's private and public sectors was formed. It was agreed that rather than a network, the development of a regional association, funded through membership fees and meeting activities, should be pursued. Important inspiration was also found during visits to and the study of the Infotish network in Kuala Lumpur. To be able to set up an organisation like this, your most important assets

are addresses, and the FAO project had on record about 2,000 names and addresses of seedsmen and seedswomen across the region. From there, the idea of an association had to be sold to the heads of seed enterprises not only within the Asia-Pacific region, but also in Europe and the US. Throughout 1993 and 1994, I therefore found myself travelling across the globe visiting seed companies and government offices in both developing and already developed countries, to introduce the APSA project.

Many private companies and national seed trade associations in developed countries were sceptical. They felt that their needs were met by the International Seed Trade Federation

and that APSA would only mean added organisational costs.

But that soon changed. Because of many years of excellent collaboration with and support from the Thai Department of Extension, we decided to hold the September 1994 foundation meeting in Thailand, with our Thai partners suggesting to use Chiang Mai as the location. The meeting was attended by a little more than 240 delegates with the Thai Permanent Secretary of Agriculture delivering the opening speech. APSA, together with the suggested Constitution and Bylaws, was agreed to, a board of 16 members was elected and funding arrangements were decided. The Asia and Pacific Seed Association was underway. 🌱

Webinars, France & Australia

APSA will offer seed education opportunities through webinars and study tours this year.

On 21 March, APSA broadcast a webinar on “Seed Shelf Life”, led by Mr. Johan Asbrouk, Chair of APSA’s Seed Technology Standing Committee (SC). The session can be viewed on APSA’s website. Due to positive feedback, APSA will be planning several more webinars in the near future.

Meanwhile, APSA’s Vegetable and Ornamental Special Interest Group (SIG) will take a group to

study vegetable seed production throughout France, with dates tentatively set for 11-18 June.

Two of APSA’s SIGs – Field Crops and Forage & Turf – are jointly organising a trip to Australia in August to attend the Australian Seed Federation’s annual Congress, and to visit numerous field and cover crop sites. APSA will notify members via our newsletter when dates and itineraries are confirmed. Meanwhile, be sure to check APSA’s news and announcements sections on apsaseed.org for updates.



New Business Development Officer Appointed



APSA is pleased to welcome Ms. Suchada “Kaew” Yansarasin as the newest member of the Secretariat.

A Thai national born and raised in the northeastern province of Maha Sarakham, Ms. Suchada has been appointed Business Development Officer, bringing rich experience to the association from similar roles with a number of Thailand-based international companies, including Reeracoen, MBMG and Powerpoint International. Having lived in Bangkok for the past 10 years, Suchada has a B.A. in English from Ramkhamhaeng University and is the youngest of three siblings, with two older sisters. She is no stranger to agriculture and the rural lifestyle. “My family in Maha Sarakham farm about 20 rai (3.2 hectares) of land, where we grow everything – rice and all kinds of vegetables. Chillies,

eggplant, cucumber, tomato, melons. I am excited to work in the seed industry, and to learn and understand more about the issues farmers face, be it pests, drought or flooding. This is a very good opportunity and I look forward to bringing back some useful knowledge for my family.” When asked about her favourite crop, Suchada did not hesitate to answer cucumbers, which she likes to eat raw, sometimes even as a stand-alone breakfast. As APSA’s Business Development Manager, Suchada will be working closely with Executive Director Heidi Gallant to improve member retention, recruit new members from all categories, and improve sponsorship and advertising programmes. “I really look forward to meeting you all in the near future. If you have any questions, please drop me an email: suchada@apsaseed.org.” 🌱

New APSA Members

SEEDWORKS INTERNATIONAL PVT. LTD.
Survey No. 530/A Gowdavally Village, Medchal Mandal, Telangana, Gowdavally 501403, India.
info@seedworks.com

OULAND SEED INC.
Room 2301 Xin Yuan Jin Rong Guang Chang (Jin Zuo), Henan Jinshui, Zhengzhou 450003, China.
xchen929@yahoo.com

SHENYANG GU YU SEED INDUSTRY CO., LTD.
101 NO.75-3 Qixingdajie, Shenbeixinq District, Liaoning Province, Shenyang City 110000, China.
guyuseeds888@163.com

INCOTEC EUROPE B.V.
Westeinde 107, Enkhuizen 1601 BL, Netherlands.
Manish.patel@incotec.com



Manila, Philippines
14-17 November 2017

APSA
THE ASIA & PACIFIC
SEED ASSOCIATION



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