Discussion on: Food Security in a World of Natural Resource Scarcity: The Role of Agricultural Technologies

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Points of discussion

- Food security issues in SE Asia
- TFP and productivity growth of rice sector in Thailand
- Adoption and limitations of technology
- Policy towards dissemination technology

Self-Sufficiency in Agriculture

 Self-Sufficiency Ratio = production*100/(production+imports-exports)

often equated with national food security indicates the extent to which a country relies on its own production resources

Self-Sufficiency in Primary Ag Prod in Asian Developing Economies

	1961-	1965-	1970-	1975-	1980-	1985-	1990-	1995-	2000-
	64	69	74	79	84	89	94	99	04
PRC	99	101	100	99	98	101	101	99	98
India	98	97	99	99	99	99	100	100	100
Indonesia	na	na	106	105	104	106	104	103	102
Malaysia	293	265	215	167	152	150	122	110	104
Philippines	115	112	116	108	106	101	101	99	99
Thailand	na	na	115	125	131	135	133	130	137
Viet Nam	na	na	na	na	na	103	104	110	112
Asian dev.									
economies ^b	100	100	100	99	97	94	88	87	85

^aAgricultural production, valued at undistorted prices, as a%age of production plus imports minus exports.

^b Includes also Bangladesh; Pakistan; Sri Lanka; the Republic of Korea; and Taipei, China. .

Source: Anderson and Strutt, 2012 based on data in Anderson and Valenzuela 2008

Agricultural Self-Sufficiency Ratio (%)

	2004	2030 core	2030 Slower prim TFP	2030 Faster ACI grain TFP
W. Europe	0.94	1.05	1.01	1.05
E. Europe	0.94	0.95	0.94	0.95
US & Canada	1.04	1.20	1.19	1.19
ANZ	1.45	1.64	1.56	1.63
Japan	0.81	0.83	0.82	0.83
PRC	0.97	0.83	0.84	0.83
ASEAN	0.97	0.85	0.83	0.86
Pacific Islands	0.92	0.90	0.88	0.90
Rest E. Asia	0.77	0.79	0.76	0.79
India	1.01	1.00	1.00	1.01
Rest S. Asia	0.96	0.85	0.90	0.85
Central Asia	1.04	1.09	1.05	1.09
Latin America	1.10	1.23	1.29	1.22
M.E. & Africa	0.93	0.92	0.93	0.92
High-income	0.97	1.09	1.06	1.09
Developing	0.98	0.91	0.93	0.92
of which Asia:	0.96	0.87	0.87	0.87
Total	1.00	1.00	1.00	1.00

Note: excludes other processed tood products; 2030 core assumes the 2004 trade-related policies do not change. TFP growth rate is set exogenously based on ADB projection ; ACI refers to ASEAN, China, and India Source: Anderson and Strutt, 2012

Self-Sufficiency in Rice

- Self-sufficiency is largely determined by production per person
- Rice production per person is determined by rice area harvested per person and yield.
- On the supply side, agricultural production can be increased through technology i.e. irrigation, improved varieties, improved application of fertilizer, mechanization.

Output	RiceArea	Output
Pop	Pop	RiceArea

Rice Area per Person, ASEAN Countries



Notes: Data are averages for 2008-2010. Raw data from FAO (2013) and USDA (2013).

Source: Dawe, 2013

Induced Innovation and Technological Change

- A change in the relative prices of the factors is itself a spur to invention, and to invention of a particular kind—directed to economizing the use of a factor which has become relatively expensive.
- Rice importers: higher output prices, relative shortage of land (increasing relative ag land price), has induced more irrigation and adoption of MV; thus higher rice yields than rice exporters.

Rice Yield, ASEAN Countries



Notes: Data are averages for 2008-2010. Raw data from FAO (2013) and USDA (2013).

Adoption of Modern Rice Varieties



Source: Dawe, 2013 based on IRRI raw data

Hybrid Rice Cultivation



[®] Source: Doberman, International Rice Research Center, pers. comm., 2011

Sources Rice Output Growth in Thailand (%) Main Crop, 1995-2011

Regions	Output	Land Lab		Capital	Fertilizers	TFP1
		(S ^H Ĥ)	(S ^L L̂)	(S ^K Â)	(S ^F Ê)	
North	-0.05	0.01	-0.61	0.30	0.46	-0.21
Northeast	2.21	0.16	0.51	0.13	0.16	1.25
Central	-1.51	-0.10	-1.07	0.31	0.15	-0.80
South	-4.00	-0.57	-4.19	0.30	-0.68	1.13
Total	-0.84	-0.12	-1.34	0.26	0.02	0.34

Note: All numbers are average annual growth rates. Growth is calculated using natural logarithm.

Factors contributing to TFP growths include Research Budget allocated to Rice Department Adoption of HYV and Irrigation (dry season)

Note: TFP1 refers to TFP growth of main rice; capital refers to agricultural credits Source: Suphannachart, 2013

Technology: Discovery, Development, Delivery



Constraints to Adoption of Ag Tech

- Relative advantage
- Compatibility
- Complexity
- Trialability
- Observability
- Farmers themselves: personality, needs, communication

Precision Agriculture

- Precision Agriculture: information-based management of agricultural production systems by apply the right treatment in the right place at the right time
- To use less fertilizer to lower-yielding and more to higher yield potential sites
- Yield increase depends on crop response to nutrient and soil type.

Precision Agriculture in Rice Production of Thailand

- Estimated impacts
 - Reduce chemical fertilizer, pesticides, seed rate
 - Increase yield
 - Reduce nutrient leakage, soil degradation



Source: Isvilanonda and Praneetvatakul , 2009; http://www.ssnm.info/

Precision Agriculture

- Evidences: energy saving, increase nitrogen-use efficiency (not necessarily lower application of N2), reduce nitrate leaching
- Not widely adopted: lack of info, agronomic services, SSN recommendation, high cost of tools
- Economic impact: labor saving (GPS guidance), high managerial time
- Soybeans & Maize yield and soil mapping in Brazil
 - more costly than conventional farming
 - Higher yields and gross revenue

Technology choices of rice farmers

- Advantage in risk-prone area:
 - Swarna-Sub1, flood tolerant rice
 - Homcholasit Rice, flash-flood tolerant rice (Thammasri and Napasintuwong, 2013)
- Trade off between high-yielding and other traits
 - Traits of hybrid rice in Thailand, valued by
 brown plant hoppers resistant, high yielding and
 height, respectively (Saelee and Napasintuwong,
 2012)

Technology Towards Food Security

- Certain technology may still be underinvestment by private sector
 - OPV rice varieties
- Balance between commodities of high surplus and high value crops
 - Vietnam and Thailand: less rice, more of high value crops

Summary

- Benefits and impacts of technology depends on appropriate use
- Not all technology will give the same impacts to all environments
- Appropriate technology can be induced by economic motivation and also supply push esp. food security reason
- Public research investment still needed
- A lot of technology dissemination policy still limits to country boundary.