

World and Regional Trends
in Maize Production, Productivity and Demand 1/

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GLOBAL MAIZE FACTS AND TRENDS

Food Grains and Coarse Grains

The global coarse grains economy is vast indeed, even when compared with wheat, rice and other grains. In 1988, for example, 729 million tons of coarse grains (largely maize, barley and sorghum) were produced on 327 million ha of land, of which "only" 97 million tons entered into world markets. Maize represents about 60% of global coarse grains production, or around 430 million tons per year. Given this perspective, Thailand's role in the international maize and coarse grains economy is exceedingly modest. Unlike the United States or the Soviet Union, Thailand has little influence over world maize prices.

Table 1
World Supply and Utilization of Major Food Grains, 1988
(million ha and million MT)

| Variable | : | Wheat | Coarse Grains | Milled Rice |
|----------------|---|-------|------------------|----------------|
| Harvested area | : | 218 | 327 | 145 |
| Production | : | 501 | 729 | 329 |
| Exports | : | 97 | 95 | 15 |
| Consumption | : | 530 | 797 | 326 |
| Ending stocks | : | 117 | 145 | 46 |

Source: USDA, 1990

Supply and Demand for Maize

Recent data suggest that increases in maize production at the global level are keeping pace with demand. Demand for maize may be broken into two components: demand for maize for direct human consumption (largely driven by population increase in lower-income developing countries) and demand for maize for livestock feed (largely driven by increases in income and in

demand for livestock products in newly industrializing countries, especially in Asia) (Sarma, 1986). Demand for maize in developed countries, whether for food or feed, is relatively stagnant.

Table 2
World Maize Facts and Trends

| Variable | : | Estimate |
|--|---|-----------------|
| Estimated population, 1990 | : | 5292 million 1/ |
| Estimated population growth rate, 1980-2000 | : | 1.7 % per year |
| Maize area, 1983-85 | : | 127 million ha |
| Average maize yield | : | 3.4 t/ha |
| Maize production (1983-85) | : | 429 million MT |
| Maize area growth rate 1961-65 to 1983-85 | : | 0.9 % per year |
| Maize yield growth rate 1961-65 to 1983-85 | : | 2.5 % per year |
| Maize production growth rate 1961-65 to 1983-85 | : | 3.4 % per year |
| Per capita total maize utilization, 1982-84 | : | 91 kg/year |
| Growth rate in per capita maize utilization 1961-65 to 1982-84 | : | 1.4 % per year |

Source: CIMMYT, 1986

1/ Brown et al, 1990.

Food and Feed Demand in Developing Countries

Domestic production of food grains in developing countries is expected to keep ahead of increases in demand for the near future, although this is not true for certain countries, many of them in Africa. It should be noted that most of the projected increase in demand can be attributed to rapid increases in demand

for livestock feed. In some countries with rapid increases in population and very rapid increases in per capita income (e.g., South Korea), the demand for feed grains is expected to increase at more than 10% per year (Paulino, 1986).

Table 3
Projected growth rates of population, production,
and domestic use of major food crops, by region
1980-2000

| Variable | : Developing : Countries | Asia |
|------------------------------------|-----------------------------|------|
| Population (% /year) | : 1.9 | 1.5 |
| Food production (% /year) | : 2.9 | 2.9 |
| | : | |
| Domestic Use: (% / year) | : | |
| Food | : 2.1 | 1.9 |
| Feed | : 4.6 | 4.4 |
| Total | : 2.7 | 2.3 |
| | : | |
| Share of Feed in Domestic Use (%): | | |
| 1980 | : 16 | 12 |
| 2000 | : 23 | 17 |

Source: Paulino, 1986

In summary, then, it can be said that the demand for maize as a feed grain, especially by rapidly developing Asian countries, will grow swiftly over the next decade. Whether Thailand can capture a large share of these rapidly expanding markets will depend on the competitiveness of Thai maize producers -- whether they can produce grain of acceptable quality at low per unit costs.

MAIZE FACTS AND TRENDS IN ASIA

Excluding China, major Asian maize producers, ranked by level of production, are as follows: India, Indonesia, Philippines, Thailand, Pakistan, Nepal (Table 4). Although India and Indonesia have higher levels of maize production than Thailand, yields per ha are much lower. Thailand has the highest maize yields among major Asian maize producers.

Table 4
Maize Production, Harvested Area and Yield
1985-87, Major Asian Maize Producers

| Country | Production 1986-88 (000 t) | Harvested | |
|-------------|----------------------------------|-----------------------------|----------------------------|
| | | Area 1986-88 (000 ha) | Yield 1986-88 (t/ha) |
| India | 7,074 | 5,788 | 1.2 |
| Indonesia | 5,960 | 3,045 | 1.9 |
| Philippines | 4,265 | 3,674 | 1.2 |
| Thailand | 4,085 | 1,706 | 2.4 |
| Pakistan | 1,123 | 808 | 1.4 |
| Nepal | 946 | 674 | 1.4 |
| Total | 23453 | 15695 | 1.4 |

Source: CIMMYT Economics Database

Yield Levels, by Country

Maize yields are uniformly low in most of these countries. Average yields exceed 2 t/ha only in Thailand. The weighted average for the listed countries is only around 1.4 t/ha, whereas experiment station yields (and yields on farmers' fields in the best production environments) are around 5 t/ha.

INDIA: In India, improved varieties and hybrids are used on more than half of the area, and fertilizer application rates are relatively high, yet yields are no higher than in any other Asian

country -- about 1.2 t/ha. One reason for this may be that rice has replaced coarse grains, including maize, in the more favorable production areas, e.g., Punjab and Haryana (Westley, 1986). Maize production is currently concentrated in areas characterized by short but intense rainy seasons (e.g., Rajasthan, Bihar) where early season waterlogging and late season drought are problems.

INDONESIA: In Indonesia, average yields are below 2 t/ha, but yield growth rates are extremely high. These spectacular observed rates of yield increase are probably due to: (1) increased use of nitrogen fertilizer on maize, stimulated by fertilizer subsidies actually aimed at rice producers (Timmer, 1986). (2) the widespread use of germplasm with reasonably high yield potential (the "unimproved local OPV's" in Indonesia are normally complex mixes of earlier releases of improved varieties) (Dahlan et al, 1987). (3) "Statistical illusion" caused by a relative shift of production from intercropped to monocropped fields.

PHILIPPINES: Yields in the Philippines are, on average, the lowest in the Asian region. Many areas of the Philippines have serious problems for maize production, including downy mildew, problem weeds, acid soils, infertile soils on hillsides, and typhoon damage. Moreover, the yield potential of the "unimproved local variety" is relatively low. Apart from a few favored areas in Southern Mindanao and the Cagayan Valley in Luzon, few farmers use hybrids or improved varieties (partly due to deficiencies in the system for multiplying and distributing seed). Fertilizer use is similarly concentrated in a few favorable areas.

THAILAND: In Thailand, little fertilizer was used on maize until very recently because of unfavorable price relationships. Nonetheless, yields are relatively high because of favorable agroclimatic circumstances (fertile ex-forest soils, adequate rainfall, few problem weeds) and the use of disease resistant OPV germplasm with high yield potential. The astonishingly high rates of production increase observed in the past have been almost entirely due to increased area. Area increase, however, can no longer be counted on as a source of increased production, especially in light of recent government actions clamping down on deforestation, including commercial logging.

PAKISTAN: Maize farmers in Pakistan use high levels of fertilizer, yet maize yields are still at somewhat low levels -- about 1.5 t/ha (Longmire, 1990). Much of the maize grown in Pakistan is grown for animal fodder and maize stover has considerable value, even relative to the value of maize grain (Sheikh, Byerlee and Azeem, 1988).

Production Growth Rates

For most major Asian maize producing countries, maize production growth rates have slowed considerably since the mid-1970's (Table 5). India and Nepal appear to face particular problems in maintaining acceptable production growth rates. In the case of India, growth in harvested area was a major source of increased production -- at least during the 1960's and early 1970's. Since the mid-1970's, however, growth in harvested area has ceased. Yield growth rates are higher now than before, but are not high enough to fully replace area change a source of

increased production.

This same general pattern holds true for the Philippines and Thailand. In these countries, growth in harvested area has not ceased but has slowed considerably. Yield growth rates in Thailand have been negligible for the last two decades, but the strong yield increases observed in 1988 and 1989 suggest that this may finally be changing.

Table 5
Growth Rates in Maize Production, Harvested Area, and Yield
1961-65 to 1972-76 VS 1972-76 to 1983-87 (% per year)
Major Asian Maize Producers

| Variable | India | Indo-nesia | Philip-pines | Thai-land | Paki-stan | Nepal |
|---|-------|------------|--------------|-----------|-----------|-------|
| Prod'n growth rate : 1961-65 to 1972-76: (% per year) | 2.9 | 0.3 | 5.8 | 10.0 | 3.6 | -0.5 |
| Prod'n growth rate : 1972-76 to 1983-87: (% per year) | 1.3 | 5.3 | 4.1 | 4.8 | 2.6 | 0.3 |
| Area growth rate : 1961-65 to 1972-76: (% per year) | 2.3 | -1.0 | 3.6 | 9.1 | 2.2 | 0.3 |
| Area growth rate : 1972-76 to 1983-87: (% per year) | -0.3 | 1.1 | 1.6 | 4.3 | 2.3 | 2.5 |
| Yield growth rate : 1961-65 to 1972-76: (% per year) | 0.6 | 1.3 | 2.2 | 0.8 | 1.3 | -0.8 |
| Yield growth rate : 1972-76 to 1983-87: (% per year) | 1.6 | 4.1 | 2.4 | 0.4 | 0.3 | -2.2 |

Source: CIMMYT Economics Database

Maize Trade, Utilization and Input Use

Of all major Asian maize producers (again, excluding China), Thailand is the only country exporting a significant proportion of its production. Most countries are minor maize importers. In addition, Thailand is unique in that only negligible amounts of maize are consumed locally, though local livestock feeding in Thailand has grown very rapidly throughout the 1980's. In contrast, given the high rates of population growth, and the importance of maize for direct human consumption in most Asian countries, the conversion of these countries into major maize exporters is virtually inconceivable.

Table 6
Maize Trade and Utilization, and Input Use
Major Asian Maize Producers

| Variable | India | Indo-nesia | Philip-pines | Thai-land | Paki-stan | Nepal |
|---|-------|------------|--------------|-----------|-----------|-------|
| Net imports as % of total production (1985-87) | 0.1% | 2.1% | 2.8% | -71.1% | -0.1% | 0.1% |
| Per cent food use maize, 1985-87 (%) | 85 | 72 | 45 | 2 | 63 | 83 |
| Percent area (1988) | | | | | | |
| - unimproved OPV | 38 | 70 | 86 | 1 | 74 | 90 |
| - improved OPV | 48 | 27 | 9 | 84 | 23 | 10 |
| - hybrids | 13 | 3 | 5 | 15 | 3 | 0 |
| Fertilizer use, 1988-89 (kg/ha) | 62 | 43 | 20 | 3 | 80 | nc |
| Farm price of maize 1988-89 (US \$/ t) | 163 | 90 | 164 | 92 | 125 | nc |
| Ratio of farm-level N price to maize price, 1988-89 | 2.1 | 2.2 | 2.9 | 7.9 | 2.6 | nc |

Source: CIMMYT Economics Database

Thailand is unique in several other ways. A higher proportion of maize area in Thailand is planted to hybrids and improved OPV's. In contrast, less fertilizer is used on maize (measured in kg/ha nutrients) in Thailand than in other Asian countries, undoubtedly due to the extremely unfavorable relationship between the price of maize and the price of fertilizer. The use of fertilizer on maize in Thailand would seem to depend more on fertilizer and maize price policies than on research on fertilizer management.

SUMMARY

Thailand would appear to be in a good position to earn a large share of the rapidly expanding world market for maize. Other major Asian maize producers seem unlikely to be competitive with Thai producers. The stiffest competition will come from developed countries. However, there is some cause for concern: annual rates of increase in maize production in Thailand have been almost entirely attributable to increases in harvested area. Although Thai maize producers have adopted improved germplasm, they are far behind other Asian maize producers in the use of fertilizer, largely because of unfavorable price relationships.

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