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Food Legume Production in Asia: Past Trends and Future Prospects *

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Food legumes — pulses, groundnuts, and soybeans — are an important source of protein and fat in the diets of people, especially in low income countries. From the early 1980s, Asian food legume production, particularly pulse output, has stagnated and declined relative to cereal production (Fig. 1). For instance in India, per caput cereal availability has increased from 403 g/day in 1971 to 450 g/day in 1984, while pulse availability has declined from 65 g/day to 41 g/day in 1984 (Government of India 1975 and 1982–84.)

The objective of this paper is to assess the prospects for increasing food legume production in Asia. This assessment is based on estimates of market parameters, the analysis of recent trends, and the results of several related studies. The expected improvements in pulse yields and in trade and processing technologies are grounds for optimism that the future of food legume production in Asia is bright. Before initiating this outlook assessment, the role of food legumes in Asia is briefly described in the next section.

Importance of Food Legumes

Food legumes account for only a small portion of the world's area and production. In Asia, pulse production (including drybeans, broadbeans, drypeas, lentils, cowpeas, vetches and pigeonpeas) amounted to only 3% of total cereal production, but 6.5% when soybeans and groundnuts are included. However, their higher value is reflected in pulse:cereal price ratios around two. Those favourable price ratios mean that food legumes are often viewed by Asian farm households as cash crops.

Nutritionally, pulses provide almost 10% of total protein intake per caput per day in Asia (Table 1). In Asia and Africa, vegetable protein sources contribute 80% of total protein intake.

The world production of food legumes in 1982–84 consisted of 57% soybean, 30% pulses, and 13% groundnuts. In Asia, pulses are proportionally more important. They account for 48% of food legume production while groundnuts and soybeans contribute 27 and 25% respectively (Table 2). Different food legumes are produced in different countries, indicating location-specific advantages (Table 3).

In Asia, the compound growth rate for production of pulses from 1970 to 1984 was 0.8% and for area under pulses 0.6%, while cereal production grew at 2.9% and cereal area at 0.6% (Table 4). In India, the major pulse producer in Asia, the rates of growth of production (0.4%) and area (0.3%) were lower than in Asia. From 1970–84, among the important producing countries, pulse production increased only in Turkey, Burma, and Thailand. By contrast, soybean production in Asia

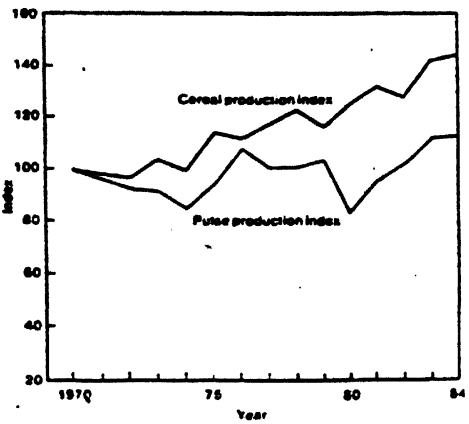

Fig. 1. Indices of cereal and pulse production in Asia, 1970–84. (Base 1970 = 100)

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has rapidly expanded. Area under soybean grew at a rate of 3.3% per annum from 1970 to 1984; soybean production grew even faster at 5.9% per annum. Area under groundnuts is slowly increasing, with a growth rate of 0.3%; production is increasing at a faster pace, by 1.4% per annum. Statistics for China have been excluded from calculations, since time-series data for China are erratic.

Demand and Supply of Pulses

Pulses are of moderate importance in Asia, and the overwhelming evidence of stagnating pulse production leads one to ask the extent to which pulse production is constrained by weak demand or by farmers' lack of responsiveness to rising market prices signalling increased demand. To examine whether demand or supply considerations are more important in conditioning output, estimates of market parameters for pulses are compared to those for other commodity groups. Comparison is restricted to India and Bangladesh where pulses are traditionally grown in large quantities and where thorough demand studies (Murthy 1983; Pitt 1983) have been conducted.

Demand Elasticities and Projections

Like other commodities, food legumes have economic characteristics which are reflected in consumers' decisions conditioned by changes in prices and incomes. These responses are measured in the form of elasticities, i.e. the percentage change in quantities demanded, given a 1% change in price or income.

In this section the income and price elasticities of demand of pulses are compared with other commodity groups for low- and high-income rural households in India and Bangladesh (Tables 5a and 5b). For India, the elasticities are reported separately for chickpeas and for other pulses as a group.

With regard to changes in income, pulses occupy a position of preference similar to rice and wheat. A 1% change in income or consumer expenditure results in about 1% increase in the quantity of pulses consumed for the lower income households in India and for the lower and higher income households in Bangladesh. For higher income rural households in India, the demand for 'other pulses' [illegible]ves like most food commodities — responsiveness declines

TABLE 1. Protein consumption per caput/day in different regions of the world (1977).

Region	Consumption (g)	Protein from[1] Pulses (%)	Protein from[1] Total non-anim sources (%)
Africa	59	10	79
North Central America	93	4	39
South America	67	11	56
Asia	58	10	80
Europe	97	2	45
World Total	69	7	65

[1] Figures are percentage of column 1.
Source: FAO 1980.

Crop	World	Asia	of Asia in world	World	Asia	of As in wo
Drybeans	25.4	12.6	50	14.8 (10)[1]	6.7 (14)	45
Broadbeans	3.3	1.9	58	4.2 (3)	2.5 (5)	61
Drypeas	8.0	1.9	24	10.2 (7)	2.4 (5)	24
Lentils	2.4	1.9	81	1.6 (1)	1.3 (3)	80
Chickpeas	9.9	9.2	93	6.5 (4)	6.0 (13)	92
Other pulses	17.3	7.1	40	9.3 (6)	3.9 (8)	44
Total pulses	66.3	34.6	52	46.6 (30)	22.8 (48)	49
Soybeans	51.0	10.3	20	87.2 (57)	12.0 (25)	14
Groundnuts	18.5	11.3	61	19.3 (13)	12.7 (27)	66
Total food legumes	135.8	56.3	41	153.1 (100)	47.6 (100)	31

[1] Figures in parentheses indicate percentage contribution of different food legumes to world and Asian production.
Source: FAO 1984.

as income rises. In general, the demand for pulses is not as strong as the demand for 'other food' and nonfood commodities in India and is weaker than the demand for milk, mustard oil and potatoes in Bangladesh. Therefore, as income increases in rural South Asia the demand for pulses is expected to rise but not as fast as for several other agricultural and nonagricultural commodities.

The elasticity estimates in Table 5a for India also indicate that consumer preferences may be markedly different for different pulses. The income responsiveness to chickpea is much less than for 'other pulses' (mainly comprised of pigeonpea). For higher income rural households, a proportional 1% increase in consumer expenditure is accompanied by less than 0.1% increase in demand for chickpea. The relative inferiority of chickpea as a pulse is not surprising. It is often grouped with cereals because flour is its most important end use. Hence, chickpea is considered as a substitute to cereals, while other pulses are viewed as complements to cereal consumption. The cross-price elasticity between the price of rice and wheat as a group and demand for chickpea is 0.411; it is −0.229 for other pulses for low income rural households in India. For high income rural households the elasticities are 0.12 and −0.07 respectively.

In India, the price elasticities of demand for rice and wheat and 'other pulses' are about the same and suggest a fairly high degree of responsiveness to changes in price, particularly for lower income households. Price elasticities of demand for pulses are also similar between rural households in India and Bangladesh. A 1% increase in pulse price leads to 0.5–0.6% fall in pulse consumption. In India, household consumption is more sensitive to changes in the price of nonfood commodities and in Bangladesh to fluctuations in the price of potatoes and rice than to changes in the price of pulses. In the short run, an increase in the supply of those commodities would likely result in a less steep fall in relative price than an equivalent increase in the supply of pulses. In any case, the estimated price elasticities of pulses in Tables 5a and 5b are not too low; thus, we do not have to be too concerned that a sharp increase in supply caused by abrupt technical change will result in an abrupt decline in prices to producers. Marketing research by Raju and von Oppen (1982) also shows that pulse markets, at least in India, are reasonably well-integrated; hence, the national market should be capable of absorbing regionally increasing supplies derived from locationally specific technical change.

TABLE 3. Average production of legumes in Asian countries 1982–84.

Country	Pulses	Soybeans	Groundnuts
India	53[1]	5	51
China (Peoples Rep)	27	79	34
Pakistan	3	—[2]	—
Turkey	6	—	—
Burma	2	—	5
Thailand	1	—	1
Indonesia	1	5	6
Japan	—	2	—
Korea (DPR)	—	3	—
Total	93	94	97

[1] Figures are percentage of total Asian production for each commodity.
[2] Negligible amount.

TABLE 4. Compound growth rates (%) for cereals, pulses, soybeans, and groundnuts for important growing countries in Asia (1970–84).

	Area				Production			
Country	Cereals	Pulses	Soybeans	Groundnuts	Cereals	Pulses	Soybeans	Groundnuts
India	0.5	0.3	5.5	0.2	2.8	0.4	5.3	1.3
Pakistan	1.4	0.1	—	—	3.9	-1.2	—	—
Turkey	0.1	6.1	—	—	3.4	5.8	—	—
Burma	-0.8	2.1	—	-1.2	5.2	2.0	—	0.6
Thailand	2.9	8.1	5.4	-1.0	3.1	4.4	6.0	-2.9
Iran	1.5	3.4	—	—	3.0	2.9	—	—
Indonesia	0.8	-2.1	-0.1	2.4	4.9	1.3	1.4	4.8
Korea (DPR)	-0.7	-0.1	-2.4	—	4.5	2.6	3.9	—
Bangladesh	1.0	-0.6	—	—	2.7	-1.9	—	—
[illegible]	1.8	-0.8	—	—	6.1	1.9	—	—
[illegible]l	1.6	2.4	—	—	0.7	2.1	—	—
Japan	—[2]	—	4.1	—	—	—	5.5	—
Korea (Rep)	—	—	-3.9	—	—	—	0.1	—
Total Asia[1]	0.6	0.6	3.3	0.3	2.9	0.8	5.9	1.4

[1] Total Asia area and production data does not include China (Peoples Rep).
[2] - = rate not calculated, values too small.

Aside from income and prices, population growth is the other important demand shifter. Demand for pulses in India is estimated to increase by 3-3.8% per annum from 1984/85 to the year 2000, depending on the assumptions regarding total expenditure growth. According to estimates by the World Bank (1981), demand in India for pulses by the turn of the century would be 20-25 million tonnes. The projections by the National Commission on Agriculture (Government of India 1976) are similar, indicating a demand in the year 2000 of 23-28 million tonnes.

Production of pulses in 1983-84 was 12.6 million tonnes. To satisfy demand, production will have to double in 20 years.

Supply

An analysis of district data for India from 1956 to 1975 on production response to changes in relative commodity and input prices indicates that the supply elasticities of pulses during that period were about 0.4, implying a price increase of 1% would be followed by an increase in production of about 0.4% (Bapna et al. 1984). From the own-price (nominal prices) elasticity estimates in that study, farmers were about as responsive to changes in pulse prices as to changes in the prices of rice, wheat, sorghum, and groundnut.

Estimates for India as a whole indicate greater price responsiveness. A recent study by Anuradha (1986) shows that pulse supply response at the national level is larger than the district estimates. The output supply elasticity of pulses with respect to real prices was estimated to be 1.1. Further, the elasticity of output with respect to yields of pulses relative to cereals was found to be 1.2, i.e. if yields of pulses (relative to cereals) increase by 1% then pulse output wil increase by 1.2%. Based on sampling of evidence it can be inferred that farmers are responsive to price changes in pulses. This will be shown for pigeonpeas in the next section.

Price and Related Area Trends

The elasticity estimates on demand and supply suggest that pulse:cereal price ratios will rise over time and that farmers will be able to respond to that economic incentive by planting more pulses. Those hypotheses are examined with emphasis on pulses, looking at trends in pulse: cereal price ratios and changes in pulse area and production.

Pulse:Cereal Price Ratios

In Table 6, the pulse:cereal price ratios from 197(to 1984 are shown for a number of major pulse producing countries in Asia. The average ratios ar

TABLE 5a. Income and price elasticities of demand for different commodity groups for low and high income group rural households in India.

Commodity group	Income elasticity		Price elasticity	
	Low income households	High income households	Low income households	High income households
Superior cereals	0.81	0.34	-0.69	-0.39
Chickpea	0.47	0.07	-0.81	-0.20
Other pulses	1.04	0.46	-0.63	-0.48
Edible oil	1.03	0.96	-0.46	-0.61
Other food	1.60	0.69	-0.82	-0.55
Non-food	1.23	1.60	-0.66	-1.00

Source: Murthy 1983.

TABLE 5b. Income and price elasticities of demand for different commodity groups for low and high income group rural households in Bangladesh.

Commodity group	Income elasticity		Price elasticity	
	Low income households	High income households	Low income households	High income households
Rice	1.19	0.94	-1.30	-0.83
Pulses	0.84	1.04	-0.68	-0.51
Mustard oil	1.03	1.31	-0.09	-0.72
Milk	2.52	1.91	-1.08	-0.25
Potatoes	1.61	1.88	-1.68	-0.96

Source: Pitt 1983.

highest in Turkey (3.1) followed by Thailand (1.86), while in Asia, the average ratio is 1.6.

For most of the pulse-producing countries in Asia, a period of decreasing or stagnant price ratios during the 1970s was followed by a period of consistently increasing price ratios from around 1980 onwards. The exception is Turkey, where the price ratios were already high during the 1970s.

The price data on general food items, such as 'pulses' or 'cereals', are highly aggregated and hence do not convey much information on the relative profitability of crops in specific farming systems. It may, therefore, be of interest to examine price trends of specific competing cereals and pulses over the same period. Trends were examined for India, where detailed data are available. The price ratios of pulses:coarse grains, pigeonpea:sorghum, pigeonpea:maize, chickpea:wheat, groundnut:pearl millet and rabi groundnut:paddy are shown in Table 7. A pattern is discernible in the behaviour of the pulse:cereal price ratios: a declining trend during the 1970s, a sharp rise around 1978/80 (the years 1978, 1979 and 1980 were agriculturally adverse, with overall decline in foodgrain production and price rises more rapid for pulses than cereals) and a subsequent drop and another increase since 1982. Since the mid-1970s cereal production has been increasing, and stagnating supplies have caused cereal price increases to taper off while pulse prices keep rising.

TABLE 6. Price ratios of pulses:cereals for important pulse-growing countries in Asia, 1970–84.

Year	India	China	Pakistan	Turkey	Burma	Thailand	Asia
1970	1.2	1.3	2.4	1.7	1.8	1.6	1.4
1971	1.2	1.3	1.6	3.0	1.9	2.0	1.7
1972	2.0	1.3	—	5.1	1.9	1.9	1.7
1973	1.7	0.8	2.4	4.2	1.5	1.3	1.3
1974	0.7	0.8	1.4	2.8	1.5	1.6	1.4
1975	0.6	0.9	0.9	1.5	1.3	1.4	1.1
1976	1.3	1.1	1.4	3.1	1.4	3.0	1.8
1977	1.7	1.3	—	4.0	2.0	2.5	2.1
1978	1.6	1.2	1.0	3.6	1.6	1.7	1.6
1979	1.9	1.0	1.1	3.9	1.3	1.7	1.6
1980	1.5	1.5	1.3	2.9	1.1	1.5	1.5
1981	1.3	1.9	1.3	2.5	1.3	1.6	1.6
1982	1.4	2.6	2.2	2.4	1.5	2.1	1.9
1983	1.4	2.4	2.1	—	1.9	1.9	1.7
1984	1.6	2.8	2.1	2.5	2.1	2.1	2.0
Average		1.6	1.6	3.1	1.6	1.9	1.6

Source:FAO 1970–84.

TABLE 7. Price ratios of selected grain legumes to competing cereals in India, 1970–84.

Year	Pigeonpea: sorghum	Pigeonpea: maize	Rainy-season pulses: coarse grains	Chickpea: wheat	Groundnut: pearl millet	Postrainy season groundnut: paddy rice
1970–71	1.5	1.5	1.6	1.1	2.2	2.1
1971–72	1.3	1.7	1.9	1.3	2.2	2.1
1972–73	1.4	1.6	2.0	1.8	1.7	3.1
1973–74	1.3	1.5	1.7	1.6	2.2	2.4
1974–75	1.4	1.4	1.4	1.3	1.8	2.1
1975–76	1.2	1.3	1.4	1.1	1.5	2.2
1976–77	1.1	1.5	1.7	1.3	2.1	3.0
1977–78	2.1	2.2	2.2	1.7	2.6	2.3
1978–79	3.0	2.6	2.8	1.6	2.3	2.4
1979–80	2.5	2.3	2.9	2.1	2.6	2.6
1980–81	2.4	2.2	2.5	2.1	2.5	3.0
1981–82	2.0	2.1	2.1	1.5	2.8	2.9
1982–83	2.3	2.1	2.2	1.4	2.7	3.0
1983–84	2.8	2.4	2.4	—[1]	3.0	—[1]
Average	1.9	1.9	2.1	1.5	2.3	2.6

[1] - = data not available.
Source: Government of India 1968–1981, 1982–1984.

Area Response to Changes in Price Ratios

To see how prices may have affected supply response over time, the data on pulse:cereal price ratios in Table 6 are presented graphically in Figs 2 and 3, with information on pulse area sown by region or country from 1970–84. Both the price ratios and the area estimates are presented in index numbers, with 100 equalling the simple average of the 15-year period. In Burma and Thailand, upward moving pulse prices appear to coincide with an expansion in area. For Turkey, Pakistan and India, and for Asia as a whole, movements in the cereal: pulse price ratios are not highly correlated with shifts in pulse area.

For India, indices of price ratios of competing food legume and cereal crops with their respective area indices of food legumes are shown in Figs 4 and 5. The area of rainy season pulses has increased in tandem with its relative price ratio. In particular, pigeonpea area has steadily increased after 1980. In contrast, area planted to chickpea, a postrainy season crop, shows no discernible upward trend. In recent years, chickpea:wheat price ratios have declined. That trend in relative chickpea prices partially supports an earlier finding on the low income elasticity of demand for chickpeas. Rainy season groundnut area is stagnant despite a favourable price ratio compared to pearl millet, while postrainy season, irrigated groundnut area has increased since the mid 1970s as the groundnut:paddy price ratio has also risen.

The data in Tables 6 and 7 and Figures 2–5 do not make a compelling case for stating that food legume:cereal price ratios have unambiguously increased and that such changes (where they have occurred) have been accompanied by a response in area planted to food legumes. Still, some food legumes, like pigeonpea and postrainy season groundnut in India, have recently gained ground. Part of their expansion in area is undoubtedly due to the more favourable relative price environment of the 1980s.

Future Prospects

There are several reasons to believe that the past trend of stagnating pulse area and production of 1970s is giving way to a moderately improving trend documented in the early 1980s.

1. Scientists expect that improved technologies in pulse production will be developed which increase yields. A Delphi study was conducted among ICRISAT scientists to assess their views on yields of

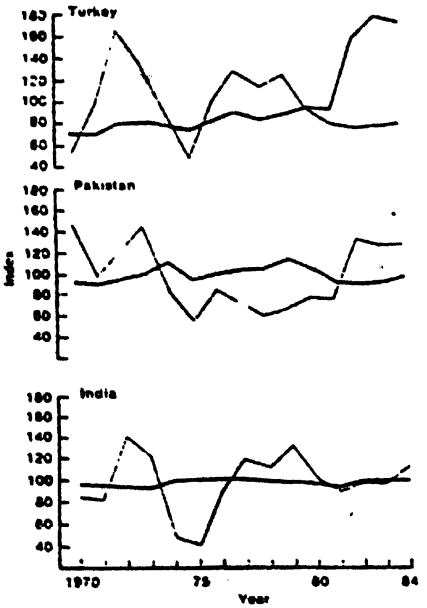

Fig. 2. Indices of price ratios of pulses to cereals and indices of pulse area in India, Pakistan and Turkey, 1970–84. (Base 1970–84 avg 100)

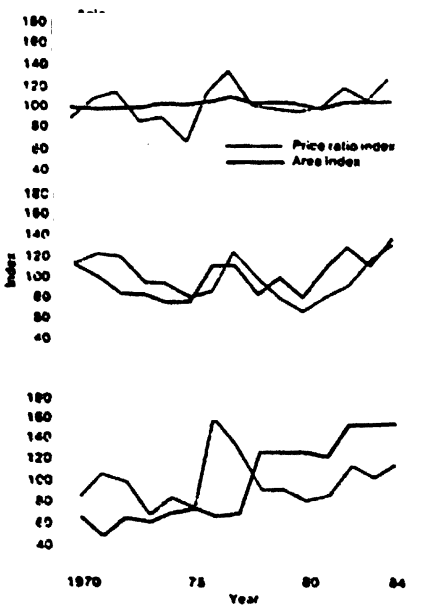

Fig. 3. Indices of price ratios of pulses to cereals and indices of pulse area in Thailand, Burma and Asia, 1970–84. (Base 1970–84 avg 100)

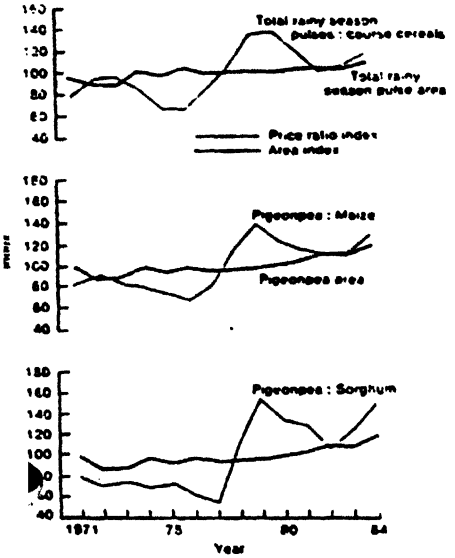

Fig. 4. Indices of price ratios of competing pulses to cereals and indices of pulse area in India, 1971–84. (Base 1970–84 avg 100)

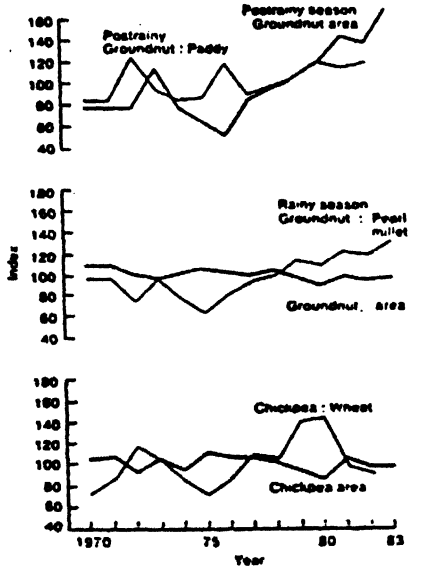

Fig. 5. Indices of price ratios of pulse and groundnuts to cereals and indices of grain legume area in India 1970–84. (Base 1970–84 avg 100)

mandate crops. The study involved a questionnaire survey in two rounds. In the first round, scientists' assessment of yields of particular crops for 1990, 2000 and 2010 were obtained. After a summary analysis of the first round, the questionnaire was recirculated, summarising the findings and offering the scientist the option to revise their earlier estimates. The results show that with current levels of resource allocation, yields in farmers' fields in India in the year 2000 will increase: pigeonpea from 880 to 1510 kg/ha (70%), chickpea from 660 to 1470 kg/ha (120%), and groundnut from 840 to 1815 kg/ha (116%). These expectations give predicted compound growth rates of 3% for pigeonpeas and 4% for chickpeas and groundnuts (von Oppen and Subba Rao 1985).

2. Trade in pulses at the world level has almost doubled from about 1.8 million tonnes in 1966–68 to nearly 3.1 million tonnes in 1982–84, i.e. from 5 to 7% of total production. This general trend of increasing pulse trade is also observed in Asia, where pulse trade (exports) increased from 0.4 million tonnes in the 1960s and 1970s to 1.1 million tonnes in 1982–84. Imports of pulses by Asian countries have increased to similar extent (Table 8). While these increases are small compared to total production, it is important to note that this trend is very recent (since 1980) and is consistent with increased production. This increase in world trade is probably a reflection of increasing commercialisation of pulse production in many producing countries and a growing demand for pulses in countries where income is rising. In contrast to pulses, 53% of soybean production entered world trade in 1984 (36% in 1976) of which 42% was traded in the form of oil. Asia is a net importer of soybean. In 1984, it imported 18 million tonnes, or 150% of local production, of which 10 million was in the form of oil.

Pulse production is location-specific; different countries have specialised in the production of particular pulses. For instance, within Asia, China produces 96% of broadbeans and 83% of drybeans. India accounts for 82% of total chickpea production (Table 9). Also, within a country pulse production varies markedly from region to region. For instance in India, pulse production is highly diverse. A single state or a few states account for bulk of the area of particular pulse crops (Sharma and Jodha 1984). If several regions specialise in the relatively best suited crops, then aggregate production from all regions should rise. Regional efforts in plant breeding, pest control, and crop management programs are likely to accelerate this specialisation. Furthermore, improvements in trade and marketing channels support regional specialisation.

A modelling exercise (von Oppen 1978) revealed that, compared to cereals, pulse production in India

is more affected by restrictions in interregional trade. The model was based on data representing the following hypothetical case. In the three Indian states of Andhra Pradesh, Madhya Pradesh, and Maharashtra, three crops, namely rice, sorghum, and chickpea were grown, and all three crops competed for the same locally available resources, particularly land. In the model, yield per acre was assumed to restrict supply, so that the total use of land for all three crops could not exceed its limits in each state. Supply was further restricted by a linear function of area response to price multiplied by yield. The initial elasticities of supply were derived from available estimates. The model also incorporated demand as a linear function of price, using available elasticities. Transportation costs between regions corresponded to official rail freight rates.

The model results showed that larger proportions of chickpea (38%) enter free interregional trade compared to rice (15%) and sorghum (19%). A trade restriction is then imposed on each of the crops, such that quantities traded will not exceed 10% of the quantities traded without restrictions. In that situation, total production of rice remained unaffected, sorghum production declined by 5%, but chickpea production decreased by 13%. Total output of all foodgrains together decreased by 2%. Over time Indian state governments have lifted many of these trade restrictions. Freer interstate trade should reinforce aggregate productivity gains from regional specialisation.

The location-specificity of pulse demand may also limit international trade. Populations in different regions are accustomed to the consumption of particular pulses, and given their consumption preferences they cannot easily switch to other protein sources. Those food legumes which are consumed in processed form (e.g. soybeans) have a relatively wide international market. As pulses are increasingly processed and consumed in the form of flours, instant foods, snacks or other preparations, it is likely that interregional and international trade will grow.

3. Pulses, in contrast to wheat, coarse grains or even rice, generally require more elaborate and costly processing before human consumption, e.g. in India pigeonpeas, chickpeas, and other pulses are dehulled and split before they are cooked. Processing is done in specialised mills. All quantities marketed and traded outside the village (about 40–50% of production in India) pass through these mills, which operate with considerable economies of scale. For instance, the cost of processing

TABLE 8. Development of pulse imports and exports for major pulse trading countries in Asia.

	Exports ('000t)				Imports ('000t)		
Country	1966–68	1974–76	1982–84	Country	1966–68	1974–76	1982–84
China (Peoples Rep)	126	85	102	China (Peoples Rep)	25	36	102
Thailand	68	104	221	India	3	6	93
Turkey	33	67	540	Pakistan	0.1	0.2	97
Burma	73	32	76	Japan	184	175	197
Syria	41	18	32	Malaysia	—	28	53
				Singapore	20	23	35
				Sri Lanka	75	13	17
				Saudia Arabia	9	12	37
Asia total	462	396	1045		470	441	839
World total	1843	1787	3088		1843	1787	3088

Source: FAO 1968, 1976, and 1984.

TABLE 9. Average production of pulses in Asian countries, 1982–84.

Country	Dry beans	Broad beans	Drypeas	Chickpeas	Lentil
India	49[1]	—[2]	14	82	40
China (Peoples Rep)	27	96	83	—	—
Pakistan	1	—	—	7	2
Turkey	3	3	—	5	46
Thailand	4	—	—	—	—
Burma	3	—	—	3	—
Total	87	99	97	97	88

[1] Figures are percentage of total Asian production for each commodity.
[2] Negligible amount.

chickpeas into split peas is reduced by 20%, from Rs 25 to Rs 20 per tonne, when the capacity of the processing unit is increased from 22 to 40 t/day (Gangwar et al. 1983).

Investments into larger mills will not be attractive as long as the industry is facing highly unstable and generally stagnant supplies from farmers. Millers have difficultly in discerning trends when the variability (measured by the coefficient of variation) in production of crops such as pigeonpeas and chickpeas is as high as 25–60% at the district level. For comparison, estimated coefficients of variation for rice production at the district level have a much narrower range were 15–30% (the coefficients of variation were calculated for important growing districts (10 for each crop) with production data from 1956 to 1979).

Once expansion has been recognised, market processors and traders are likely to invest because profits from large mills can be considerable. Market competition will force traders and millers to share [illegible]e costs advantages with the farmer, and this in [illegible]n will accelerate the supply response of farmers.

The development of India's soybean industry is a good case in point. Growth has been exceptionally rapid and parallels what happened in Brazil in the 1960s. The rapid adoption of a new crop is proof of farmers' responsiveness to market demand and of the processing industry's ability to convert to profitable enterprises (von Oppen 1982).

4. Recently, policy-makers in many Asian countries have become aware of the negative welfare implications of high pulse prices to poor consumers and have begun to implement programs to boost pulse productivity (Asian Productivity Organization 1982). In several Asian countries this concern stems from achieving cereal self-sufficiency at the cost of oilseeds and pulses. Governments in India, Indonesia, and Thailand have now begun to pay more attention to pulses in their development planning (McWilliam and Dillon, these proceedings).

Summary

Over the past 15 years food legume production in Asia, except for soybean and to a lesser extent groundnuts, has been stagnant. The production of pulses has declined in several Asian countries. [illegible]nonetheless, there appear to be indications that the [illegible] upward trends in pulse production passed their lowest point in 1980/82 and that the upward movement observed in recent years may continue. This assessment is based on the following observations: pulse prices (relative to cereals) are rising for some species; improvements in marketing and processing facilities should increase response to market demand; national and international trade in pulses is increasing; scientists are optimistic regarding the possibilities for increasing yields in farmers' fields; and policy-makers have expressed concern for the welfare implications of decreasing relative pulse production. To substantiate and evaluate the consequences of these emerging trends, more information is needed on commodity demand and supply estimates and on cost of production between pulses and competing crops.

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