# WORLD PRODUCTION AND TRADE IN GRAIN LEGUMES

**G.D. Hill**

Plant Science Department
Lincoln University
Canterbury

## ABSTRACT

Compared with the major cereals the annual world production of grain legumes is relatively small and amounts to 171 million t. Only about 21% of this production enters international trade and trade in grain legumes is dominated by a single species the soya bean, which in 1987 accounted for 82% of the total trade. However, imports of other grain legumes into Europe and South East Asia have increased rapidly in the last ten years and these two regions combined with Latin America account for 78% of the total tonnage traded. With a knowledge of which grain legumes are preferred in a particular market it is possible to deduce which species are most likely to be in demand.

For New Zealand it appears that besides our traditional market in peas export opportunities exist for sale of lentils and Desi chickpeas in the Indian sub-continent, large seeded faba beans in North Africa and the Arabian Countries and dry *Phaseolus vulgaris*, Kabuli chickpeas and lentils in Europe. Latin American imports are probably mainly dry *Phaseolus vulgaris*.

On the local market opportunities exist for import replacement of peanuts, which can be grown in the north of the North Island and for dry *Phaseolus vulgaris* for production of baked beans, as appears to have happened since 1987. Finally, New Zealand currently imports $NZ 32 million worth of of soya bean products a year. There is no apparent reason why these could not be produced from locally grown and processed beans.

## PRODUCTION

For thousands of years legume seeds as a source of human food have enjoyed a poor press. Even in the Bible legumes are referred to as poor mans' meat. Studies which relate per-capita income with grain legume consumption by humans have shown a strong negative relationship between the two at both the national and international level (Aykroyd & Doughty, 1964). However, considerable amounts of grain legume seed are consumed by humans in the developing countries as a high protein supplement to cereal based diets. Further, as people in the developed countries become more conscious of the effect of eating large amounts of animal products on their health, the consumption of pulses has been rising.

Major traditional species are faba beans (*Vicia faba*) in China, North Africa and around the Mediterranean basin, Desi chickpeas (*Cicer arietinum*), lentils (*Lens culinaris*), and pigeon pea (*Cajanus cajan*) on the Indian sub-continent, soya beans (*Glycine max*) in China, Indonesia and Japan, common beans (*Phaseolus vulgaris*) in Central and South America and cow peas (*Vigna unguiculata*) in West Africa.

Besides these major species there are a number of minor legume species that are also used in human diet. These include *Lupinus albus* in the Southern Mediterranean region, *Lupinus mutabilis* in the Andean region of South America, *Dolichos uniflorus*, *Lablab niger*, *Lathyrus sativus*, *Psophocarpus tetragonolobus* and *Vigna radiata* in Asia, and *Phaseolus lunatus* in the Americas. Figures for the world production of these species are not readily available and similarly, probably little enters world trade. However, because of their specific climatic adaptation and their ready dietary acceptance they are all important at a local level.

In trade and production statistics peanuts (*Arachis hypogea*) and soya beans are not included with the pulses (FAO, 1988a,b,c). Presumably this is because of their importance as oil seed crops. However, as the residues left over after oil-crushing are an important protein source for feeding of both monogastric and ruminant livestock particularly, in North America,

Europe and Japan they are in direct competition with the other grain legumes. Therefore, they will be discussed in this paper with the other pulses.

## WORLD PRODUCTION

The total world area sown to all grain legumes in 1987 was 138.4 million ha. This area gave a total production of 171.4 million t (Table 1). Production of grain legumes was considerably below that of most of the major cereals which amounted to between 400 and 500 million t. The amount produced was roughly equivalent to that of barley (178.5 million t)(FAO, 1988a).

**Table 1. Total world production of grain legumes and selected cereals, 1987.**

| Crop | Production ($10^6$ t) |
|---|---|
| Wheat | 516.8 |
| Maize | 457.4 |
| Rice | 454.3 |
| Barley | 178.5 |
| Grain legumes | 171.4 |

Of total grain legume production 51.6 million ha and 98 million t was from soya beans (Table 2). Major soya producing nations are the United States (22.8 million ha; 51.2 million t), Brazil (9.2 million ha; 16.9 million t) and China (8.4 million ha; 12.1 million t). Next in importance in terms of total production are peanuts (Table 2). Peanuts are not currently grown commercially in New Zealand but North Island trials have indicated their potential (Anderson & Piggot, 1981). Total world production in 1987 was 20.1 million t from 18.1 million ha. Current major producers are China (3.1 million ha; 6.1 million t), India (6.3 million ha, 4.5 million t) and the United States (0.6 million ha; 1.6 million t)(FAO, 1988a).

Among the legumes production then falls to peas at 14.5 million t (Table 2) grown on 9.8 million ha. Countries which produced over one million tonnes of peas included Russia (6.8 million t), China (1.9 million t) and France (1.8 million). Across the Tasman Australian production of peas has increased from 55,000 t in 1981 to 887,000 t in 1987 (FAO, 1988a).

Almost as many dry beans are produced as peas (Table 2). World production in 1987 was 14.0 million t grown on 26.6 million ha. Average world yield is low at 558 kg/ha. Major producing nations are Brazil (2.0 million t; 5.2 million ha), the United States with considerably higher yields (1.2 million t; 0.7 million ha) and Mexico (1.0 million t; 2.3 million ha). The figures for India at 2.5 million t from 9.2 million ha and China 1.6 million t from 1.4 million ha suggest that all of the production data reported in Table 32 of the FAO Production Yearbook 1987 (FAO, 1988a) are not derived from the same legume species as *Phaseolus vulgaris* is not generally considered to be a major crop in India.

**Table 2. World production of individual grain legumes, 1987.**

| Crop | Production ($10^6$ t) |
|---|---|
| Soya beans | 98.0 |
| Peanuts | 20.1 |
| Peas | 14.5 |
| *Phaseolus* | 14.0 |
| *Cicer* | 6.8 |
| *V. Faba* | 4.5 |
| Lentils | 2.6 |

Chickpeas are next in importance in terms of world production (Table 2). For this crop, world production is dominated by India, which produced 4.5 million t from 6.7 million ha which was 65 % of total world production. It is probable that the majority of the chickpeas produced in India are the red, small seeded Desi type rather than the large cream Kabulis which are more sought after in the developed world. Other major chickpea producers are Turkey (750,000 t from 666,000 ha) and Pakistan, again probably mainly Desi (583,000 from 1.1 million ha)(FAO, 1988a).

Production then falls still further to *Vicia faba* at 4.5 million t. China is the single major producer at 2.4 million t. However, it is a popular crop in North Africa with Ethiopia producing 480,000 t and Egypt (where it a popular staple of diet (ICARDA, 1985)) 323,000 t. In Western Europe both West Germany and Italy produce more than 175,000 t (FAO, 1988a).

The final crop to be given separate status in the FAO statistics (FAO, 1988a) is lentils at 2.6 million t. The major producer is Turkey with 950,000 t. Other large producers are India (666,000 t) and Canada (328,000 t). New Zealand does not feature in the international statistics of lentil production as the New Zealand Department of Statistics does not keep records of the area sown to this crop, or of the other grain legumes except for peas. However, if the exports of 2,400 t (Department of Statistics, 1989) are added to the estimated internal demand of 200 t suggested by Logan (1983) the total of 2,600 t suggests that New Zealand currently produces 0.1 % of total world lentil production.

## WORLD TRADE IN GRAIN LEGUMES

Although the total world production of grain legumes is in excess of 170 million t only a small amount of this production enters world trade (Table 3). Soya beans were traded most and from 1985 to 1987 the amount of the crop entering trade varied from 25 % to 30 % of total production. In 1987 Europe imported 16.2 million t of soya beans with Great Britain, Belgium, West Germany, the Netherlands, Italy, Spain and Jugoslavia all importing in excess of one million t. In Asia Japan and South Korea imported nearly 6 million t (FAO, 1988b).

**Table 3. A comparison of total production of grain legumes (excluding soya beans and penauts) and amount entering world trade, 1985-87.**

| Year | Production ($10^6$ t) | Trade ($10^6$ t) |
|---|---|---|
| 1985 | 51.4 | 3.9 |
| 1986 | 53.4 | 4.6 |
| 1987 | 53.3 | 5.1 |

World sales of peanuts are probably of less direct interest to New Zealand. However, from 1985 to 1987 about 5 % of the total crop entered world trade (Table 3). As with soya beans major purchasers were in Europe which took nearly half the 1.1 million t traded (FAO, 1988b).

With regard to the remaining grain legume species totals entering world trade compared with production are small and from 1985 to 1987 ranged from 7.6 to 9.6 %. The total tonnages involved were never more than 5.1 million t a year. Unfortunately, the FAO Trade Yearbook (FAO, 1988b) does not distinguish among pulses so no specific information is available as to the major destinations of particular species.

## TRENDS IN WORLD GRAIN LEGUME IMPORTS

Although it is not possible to distinguish among legume species as to their final destination in world trade it is possible to distinguish where major changes in imports are occurring (FAO, 1988c). Over the period from 1976 to 1986 there have been two major growth regions for grain legume sales (Table 4) (FAO, 1988c). Major increases in imports of grain legumes have occurred in Western Europe where imports rose from 821,000 t in 1976 to 2.1 million t in 1986. This was an annual rate of growth of 9.01 %. The rate of growth of legume imports in the South East Asian market has been even more spectacular. Over the same period imports rose from 90,000 t to 841,000 t. This was an annual growth rate of 23.64 %.

**Table 4. Changes in imports of grain legumes to Latin America, South East Asia and Western Europe, 1976-86 ($10^6$ t).**

| Year | Latin America | South East Asia | Western Europe |
|---|---|---|---|
| 76 | 0.30 | 0.09 | 0.82 |
| 77 | 0.40 | 0.09 | 0.89 |
| 78 | 0.29 | 0.16 | 0.91 |
| 79 | 0.28 | 0.21 | 1.05 |
| 80 | 0.82 | 0.21 | 1.01 |
| 81 | 0.88 | 0.38 | 0.92 |
| 82 | 0.74 | 0.38 | 1.07 |
| 83 | 0.52 | 0.37 | 1.31 |
| 84 | 0.51 | 0.47 | 1.43 |
| 85 | 0.61 | 0.56 | 1.87 |
| 86 | 0.52 | 0.84 | 2.09 |

Considering the large quantity of legume seed produced by countries such as Argentina, Brazil and Mexico it is surprising that Latin America is also a very significant market. Imports ranged from 291,000 t to 878,000 t during the period and were 523,000 t in 1986.

Annual market growth was 6.81 % over the eleven year period (FAO 1988c). In the rest of the world over the same period the volume of legume imports ranged from 620,000 t to just over 1 million t. Purchases by the rest of the world have virtually been static since 1981.

## THE NEW ZEALAND SCENE

Peas as frozen vegetables, dried for human consumption and for sowing are the major grain legume exported from New Zealand (Table 5, 6) (Department of Statistics, 1989). In the year ending October 1989 the value of pea exports was $NZ 43.3 million (Table 5). The majority of the returns came from frozen peas either alone or mixed with other vegetables ($NZ 22.3 million). Significant returns also came from dried pea ($NZ 16.6 million) and pea seed exports ($NZ 6.8 million).

**Table 5. Value of New Zealand legume based exports and imports (November 1988 - October 1989) ($NZ x $10^6$).**

| Crop | Exports | Imports |
|---|---|---|
| Peas | 47.1 | - |
| Lentils | 1.8 | - |
| Soya beans | - | 32.6 |
| *Phaseolus* | - | 7.3 |
| *Cicer* | - | 0.1 |

On the export scene in recent years probably the most spectacular increase has come form lentils. When Logan (1983) wrote her report she estimated that New Zealand had an internal demand for 200 t of lentils per annum and was importing 101 t. Exports in the November 1988 to October 1989 year, which followed a severe drought in the main growing area of Canterbury, were 2,374 t. Allowing for seed for resowing, this suggests total production of about 2,600 t per annum.

There has also apparently been a major change in New Zealand production of dry beans in the last few years. In 1885/86 dry *Phaseolus vulgaris* imports were 2,000 t which cost $NZ 2.4 million (Department of Statistics, 1987). By late 1989 New Zealand imports were only slightly greater than exports. The country imported 278 t and exported 250 t of dry beans. The majority of the production was exported as agricultural seed at an f.o.b price of $NZ 1,397 /t. However, further import savings are still possible as the import price (c.i.f.) was $NZ 2,056 /t (Department of Statistics, 1989).

**Table 6. Value of New Zealand pea exports by product type (November 1988 - October 1989) ($NZ x $10^6$).**

| Product | Value |
|---|---|
| Frozen | 22.31 |
| Dried | 16.61 |
| Seed | 6.86 |
| Other | 0.55 |

Turning now to legume imports it is somewhat dismaying to find that the income earned from pea exports is almost equalled by the cost of imported soya bean products at $NZ 31.6 million (Table 5, 7) (Department of Statistics, 1989). As Wynn-Williams & Logan (1985) indicated there are no major agronomic problems with growing soya beans in New Zealand. The main limitation in the production of this crop is the absence of an oil extraction plant. The majority of the current imports derived from soya are in the form of oil at 20 million l. A tonne of soya beans yields about 150 l of oil therefore the amount of the crop that would need to be grown to produce this amount of oil would be approximately 136,000 t of soya beans. At an average yield of 2.5 t/ha this would require a crop area in excess of 54,000 ha. Further, this amount of seed would produce about 108,000 t of soya bean meal compared with current New Zealand imports of 2,946 t (Department of Statistics, 1989). This considerable excess of soya bean meal would have to be either absorbed by the local pig and poultry feed processing industry or exported.

The situation with peanuts is less complex. As there are no crushing facilities in New Zealand the 4,700 t that are imported are used for the confectionary trade and in the production of peanut butter. Over the last twelve months the average price of peanuts landed in New Zealand was $NZ 1,410 /t. Whether this would be an economic price for farmers to grow the crop locally will depend on the cost of production in New Zealand, and the yield obtained. An implied possible return of $NZ 3,800 /ha suggested by the results of Anderson & Piggot (1981) would, superficially, seem attractive.

**Table 7.** **Value of New Zealand soya bean based imports by product type (November 1988 - October 1989) ($NZ x $10^6$).**

| Product | Value |
|---|---|
| Oil | 20.78 |
| Meal | 9.42 |
| Sauce | 0.87 |
| Seed | 0.51 |

The final legume imported in any quantity is chickpeas. Total imports were small, a mere 69 t for the 1988/89 year (Table 5). The average cost was $NZ 1,123 /t (Department of Statistics, 1989). Hernandez & Hill (1985), in Canterbury, obtained a yield of 2.7 t/ha of Kabuli chickpeas from a variety which had not been selected for the New Zealand environment.

Not featuring in the list of imports or exports but easily grown in this country is *Vicia faba*. Newton & Hill (1978) reported farm yields of up to 6.2 t/ha. ICARDA (1985) indicated that the average Egyptian consumed 9 kg of dry *Vicia faba* a year. The current population of Egypt is 49 million (FAO, 1988a) which gives an annual demand for this crop in excess of 400,000 t. Egypt currently imports 76,000 t of pulses each year. Thus *Vicia faba* would also appear to be a crop with export potential particularly the large seeded varieties.

## CONCLUSIONS

There are a range of options available among the grain legumes for potential exports and for import replacement for New Zealand arable crop farmers and for food processing companies who wish to diversify their production by growing and processing grain legumes. Further work is required on the agronomy of some of the crops and certainly for some species varieties need to be imported or bred that are well adapted to the New Zealand environment. The remaining papers in this workshop will survey potential markets in greater depth and the review the current state of knowledge on grain legumes to identify future research priorities.

## ACKNOWLEDGEMENTS

The staff of the Lincoln University Library for their assistance, at very short notice, in helping me to find and understand the New Zealand Import/Export statistics.

## REFERENCES

Anderson, J.A.D. & Piggot, G.J. 1981. Peanuts: A possible crop for warm northern areas of New Zealand. *Proceedings of the Agronomy Society of New Zealand 11*: 73-75.

Aykroyd, W.R. & Doughty, J. 1964. Legumes in human nutrition. *FAO Nutritional Studies No. 19*: 1-138.

Department of Statistics, New Zealand. 1987. Imports 1985/86. *Statistical Data on Microfiche.*

Department of Statistics, New Zealand. 1989. Imports and exports November 1988 to October 1989. *Statistical Data on Computer File.*

FAO. 1988a. *FAO Production Yearbook 1987, FAO Statistical Series No 82 41.*

FAO. 1988b. *FAO Trade Yearbook 1987, FAO Statistical Series No 84 41.*

FAO. 1988c. The state of food and agriculture 1987-88. *FAO Agriculture Series No 21.*

Hernandez, L.G. & Hill, G.D. 1985. Effect of sowing date and plant population on growth and yield of chickpea (*Cicer arietinum* L.). *Proceedings of the Agronomy Society of New Zealand 15*: 81-85.

ICARDA. 1985. Harvest of Research, Highlights of the IFAD/ICARDA Nile Valley Project 1979-1985. International Center for Agricultural Research in the Dry Areas; Aleppo.

Logan, L.A. 1983. Crop production and utilisation in New Zealand. *Crop Research Division, DSIR, Report No. 81.*

Newton, S.D. & Hill, G.D. 1978. A survey of commercial field bean (*Vicia faba* L.) crops in Canterbury. *Proceedings of the Agronomy Society of New Zealand 8*: 31-35.

Wynn-Williams, R.B. & Logan, L.A. 1985. The course of research and development of alternative arable crops in New Zealand. *Proceedings of the Agronomy Society of New Zealand 15*: 93-102.