Staff Paper

Global and Regional Trends in Production, Trade and Consumption of Food Legume Crops

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Abbreviations

CA	Central Asia
CGIAR	Consultative Group on International Agricultural Research
CV	Coefficient of Variation
DW	Developing world
EA	East Asia
FAO	United Nation's Food and Agriculture Organization
gm	gram (measurement unit)
Ha	hectare
IITA	International Institute for Tropical Agriculture
INR	Indian Rupee
Kcal	kilo calories
Kg	Kilogram
LAC	Latin America and the Caribbean
MENA	Middle East and North Africa (also referred as WANA)
MPCE	Monthly Per Capita Consumption Expenditure
nes	not elsewhere specified
NSS	National Sample Survey
NSSO	National Sample Survey Organization (India)
Ph.	Phaseolus
ROW	Rest of the World (refers to developed countries)
SA	South Asia
SEA	Southeast Asia
SSA	Sub Saharan Africa
t	metric tons
WA	West Africa
WANA	West Asia and North Africa (also referred as MENA)
WHO	World Health Organization

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Abstract

Food legumes play an important and diverse role in the farming systems and in the diets of poor people around the world. They are ideal crops for simultaneously achieving three developmental goals in targeted population—reducing poverty, improving human health and nutrition, and enhancing ecosystem resilience. This report provides global and regional trend analysis and sheds light on the pulse crop production, price, trade, and consumption patterns observed in the developing world, developed countries and globally from mid-1990s to 2008. The study is conducted through a review of secondary data and published research and analysis reports, and presents data and analysis for cereals to compare and contextualize the trends, patterns and outlook for pulses.

Globally, the harvested area under pulse crops is about one-tenth the harvested area under all cereal crops and a high proportion of pulse area harvested is under rainfed-low input systems compared to cereal crops. Thus, in 2008, the average global yields of pulse crops (0.86 t/ha) was only about one-fourth the average yields of cereal crops (3.54 t/ha). On the bright side, over the past 14 years, the overall pulse production has increased at a rate higher than the growth rate in population both in developing and developed countries. Over this time period, SSA has led the developing world in terms of contribution to production growth through growth in yield (but with a low base). A major share of the pulse production growth rate in developed countries has been area expansion, especially in countries like Canada. In terms of production growth rate among major pulse crops, cowpeas and soybean in West Africa have shown the biggest increase, which are followed by pigeon peas and dry beans. However the overall picture for faba beans, chickpeas and lentils over the last 14 years has not been so favorable with small positive growth rate for faba beans and an overall negative growth rate for lentils due to decline in area.

Farm-gate prices for pulses have fluctuated during the past 14 years due to supply and demand mis-match, and have experienced an upward pressure recently. This pressure is expected to continue in the near future but may be reversed in the medium and long term. Over the past 14 years, developing countries on aggregate have increasingly met their growing pulse requirements through increased imports and have now become net importers of pulses. Trade in pulses grew more rapidly between 1994 and 2008 than output. The expansion in international trade of pulses has provided a good opportunity for several developing and developed countries to expand their exports. China, Myanmar and Argentina, among developing countries, and Canada, U.S. and Australia among developed countries have emerged as major exporters of pulses. However, despite this rapid growth in exports and imports, pulse trade remains a relatively thin market, especially when compared to other food commodities, such as cereals and oil crops.

On the demand side, over the past 14 years, a stable and modest positive trend in per capita consumption is observed within the context of a declining overall historical trend. This declining historical trend in per capita consumption of pulses is expected to continue into the future. Dietary patterns are changing all over the world and the share of non-cereal foods in the total calorie and protein consumption is increasing. However, at least over the past 14 years, pulses have not seen a dramatic decline in the total calorie and protein contribution as seen by the cereal crops. Household level survey data from India show the continuing importance of pulses as a source of protein in poor people's diet, despite the overall changing dietary pattern, rising income and declining per capita consumption of pulses.

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I. Introduction

Food legume[2] crops represent an important component of agricultural food crops consumed in developing countries and are considered a vital crop for achieving food and nutritional security for both poor producers and consumers. As a matter of fact, in dietary terms, food legumes complement cereal crops as a source of protein and minerals while agronomically they serve as rotation crop with cereals, reducing soil pathogens and supplying nitrogen to the cereal crop (Beebe, no date). Food legumes also serve as a feed crop in many farming systems and fetch higher prices compared to cereals and are increasingly grown to supplement farmers' incomes (Gowda et al., 1997). The important and diverse role played by food legumes in the farming systems and in diets of poor people, makes them ideal crops for achieving the CGIAR's developmental goals of "reducing poverty and hunger, improving human health and nutrition, and enhancing ecosystem resilience."

Given the importance of food legumes in developing countries, the objectives of this study are to:

- Provide a thorough review and contextual analysis of the food legume economy at the global and regional levels; and
- Assess commodity-specific trends and developments in food legume crop productivity, cultivated area, price, trade and consumption since the mid-1990s.

The study focuses on the following six pulse crops: pigeonpea (*Cajanus cajan*), chickpea (*Cicer arietinum*), lentil (*Lens culinaris*), common bean (*Phaseolus vulgaris*), cowpea (*Vigna unguiculata*) and fababean (*Vicia faba*), and one legume oil crop--soybean (*Glysine max*) (only for West Africa region).[3] We have included soybean in this report with a focus on West Africa because the International Institute for Tropical Agriculture (IITA) has done extensive work in soybean improvement research and is promoting it as a food legume in people's diets, either directly as a food grain, in processed form (e.g., soynuts, soymilk, soy pulp) or as a fortifier in traditional foods.

The regional analysis is focused on developing countries and includes the following regions: Southeast Asia (SEA), East Asia, including China (EA), South Asia (SA), Central Asia (CA), Middle East and North Africa (MENA), Sub-Saharan Africa (SSA), and Latin America (including the Caribbean) (LAC). For soybean, we focus only on one region--West Africa (WA). Developed countries/regions are included in the analysis under the group referred as "Rest of the World" (ROW, which includes Europe, North America, Australia, New Zealand, and Japan) to give a global picture. The list of countries included in different regions as defined by FAO is given in Annex 1. The analysis focuses on data from 1994 to 2008 (which is the last year of comprehensive data available at the time of writing this report) for most themes.[4]

The study is conducted through a review of secondary data, published research and analysis reports, and results of survey data reported in published studies. In general, there is paucity of comprehensive and

[2] The terms 'food legume crop' and 'pulse crop' are used synonymously and interchangeably in this paper.
[3] Grass pea (*Lathyrus sativus*) is an important legume crop in some parts of the world. However, due to lack of data, this crop is not included in the analysis presented in this paper.
[4] For global facts and trend in pulse crops prior to 1995, see in-depth analysis by Kelley et al. (2000) covering the period 1980 to mid-1990s and Agostini and Khan (1988) (cited by Kelley et al. 2000) covering the period prior to 1980s.

reliable time series data on pulse and legume crop production, trade and consumption in developing countries. These crops are often 'minor' crops in many developing countries and thus do not receive the same level of attention by the country's agricultural statistical units in the documentation and reporting protocols as important cereal crops. Despite the many weaknesses of the FAO data on agricultural production (which relies on data reported by the national agricultural statistical units), this report uses FAOSTAT as a primary source of secondary data for reporting time series, and global and regional analysis of food legume crops. At the outset, it is thus important to recognize the following limitations and problems with the FAOSTAT data as they relate to some of the focused legume crops in this report.

First, for 'common beans' (*Phaseolus vulgaris*), there is no one-to-one correspondence between this crop and the categories reported in FAOSTAT. Table 1 provides the definition of different categories of crops reported in FAOSTAT and how they relate to the seven crops which are the focus of this report. As can be seen, the most problematic of these categories is what FAO reports as 'dry beans.' This category includes all species of *Phaseolus* beans, including common beans, mung beans, black gram, lima beans and adzuki beans.[5] Although they belong to genus '*Phaseolus*,' they each have unique agronomic requirements, are grown in different geographic regions with different socio-cultural, economic and environmental settings, and thus face different sets of research problems and opportunities. In some regions, the common bean (*Phaseolus vulgaris*) may be the major legume crop produced (i.e., many parts of Central America) and thus there may be a good fit between what is reported by FAO as 'dry bean' and common bean. But in other regions it may be one of the many types of *Phaseolus* beans produced and consumed in the region. For example, in South Asia and East Asia, other types of beans, such as mung beans (*Vigna radiata*), black gram (urad or *Vigna mungo*), moth beans (*Vigna aconitifolius*) and adzuki beans (*Vigna angularis*) are important. Thus, there may not be a one-to-one comparison of our focused commodity 'common beans' and what FAO reports as 'dry beans' in these regions. To avoid any misinterpretation, we avoid the use of 'common beans' when reporting data from FAO. Data from FAO for '*Phaseolus*' and other '*Vigna*' beans (except, cowpea) are reported as 'dry bean,' which in some countries and regions may be a gross overestimation of area and production under 'common bean' (*Phaseolus vulgaris*) (See Annex 2 for an illustration of this point for pulse data from India and an attempt at partitioning the area reported by FAO in 2006-08 period under dry bean into area under common bean and other types of beans).

Second, FAOSTAT reports a category of pulse crop called "pulse, nes," which basically includes all the legume pulse crops "not elsewhere specified" under any other FAO pulse crop categories. These are usually pulse crops of minor relevance (e.g., lablab or velvet beans) at the international level, or may be major pulse crop categories but of limited local importance (e.g., cowpea in Central and South America or common beans in West Africa). Typically, these minor crops are all lumped together as 'pulse, nes' when reporting to FAO, and cover about 6 to 7% of total global area under what FAO defines as Pulse crops.[6] Because they are not identifiable with any specific category of pulse crops, we do not include 'pulse, nes' category in this report. What this implies is that to the extent this category corresponds with one of the seven pulse crops we are focusing in this report, we may be excluding small producing countries in the analysis.

[5] Some of these types of 'beans' have been recently transferred to genus *Vigna.*

[6] FAO defines 'Pulse crops' to include the following crops, the first six are the focus of this study and the last five are not: Dry Beans, Broad beans, Chick peas, Cowpeas, Lentils, Pigeon peas, Bambara beans, Lupins, Dry Peas, Pulses, nes, and Vetches (see http://www.fao.org/WAICENT/faoinfo/economic/faodef/fdef04e.htm#4.02 for definition). Note that soybean is defined by FAO as an 'oil crop' and not a 'pulse crop.'

Table 1. Definition of legume crops focused in this study and corresponding item name in FAOSTAT

Focused crop in this study	Scientific name	Corresponding FAO Item Name & Code	FAO Definition	Implications for this study
Common beans	*Phaseolus vulgaris*	None	--	No one-to-one correspondence with data and analysis based on FAOSTAT data
Faba beans	*Vicia faba*	Broad beans, horse beans, dry (181)	*Vicia faba*: horse-bean (var. equina); broad bean (var. major); field bean (var. minor).	**Reported as faba beans**
Chickpeas	*Cicer arietinum*	Chick peas (191)	Chickpea, Bengal gram, garbanzos (*Cicer arietinum*).	**Reported as chickpeas**
Cowpeas	*Vigna Ungiculanta*	Cow peas, dry (195)	Cowpea, blackeye pea/bean (*Vigna sinensis; Dolichos sinensis*).	**Reported as cowpeas**
Lentils	*Lens culinaris*	Lentils (201)	Lens esculenta; Ervum lens.	**Reported as lentils**
Pigeon peas	*Cajanus Cajun*	Pigeon peas (197)	Pigeon pea, cajan pea, Congo bean (*Cajanus cajan*).	**Reported as pigeon peas**
Soybeans	*Glysine max*	Soybeans (236)	*Glycine soja*.	**Reported as soybeans**
--		Beans, dry (176)	*Phaseolus* spp.: kidney, haricot bean (*Ph. vulgaris*); lima, butter bean (*Ph. lunatus*); adzuki bean (*Ph. angularis*); mungo bean, golden, green gram (Ph. aureus); black gram, urd (*Ph. mungo*); scarlet runner bean (*Ph. coccineus*); rice bean (*Ph. calcaratus*); moth bean (*Ph. aconitifolius*); tepary bean (*Ph. Acutifolius*). Several countries also include some types of beans commonly classified as *Vigna* (*angularis, mungo, radiata, aconitifolia*).	**Reported as dry beans.** • Includes all species of *Phaseolus*. In some countries it corresponds to common beans where that is the only *Phaseolus* species grown. • Because this Item includes so many major types of beans, the data are not strictly comparable across countries and regions (see Annex 2 for an attempt at disaggregating dry bean area into common bean and other beans).
---		Pulses, nes (211)	Including inter alia: lablab or hyacinth bean (Dolichos spp.); jack or sword bean (Canavalia spp.); winged bean (Psophocarpus tetragonolobus); guar bean (Cyamopsis tetragonoloba); velvet bean (Stizolobium spp.); yam bean (Pachyrrhizus erosus); *Vigna* spp. other than those included in 176 and 195	This category includes other pulses that are not identified separately because of their minor relevance at the international level. Because of their limited local importance, some countries report pulses under this heading that are classified individually by FAO. This category is not explicitly focused in this study—but included in some analysis for comparison
---		Pulses	As an aggregate category, it includes the following crops: Dry Beans, Broad beans, Chick peas, Cow peas, Lentils, Pigeon peas, Bambara beans, Lupins, Dry Peas, Pulses, nes, and Vetches	This aggregate category is not explicitly focused in this study—but included in some analysis as an aggregate category for comparison with cereal crops

A third limitation to note about the FAO data is that there may be significant gaps in the data in terms of missing data for important legume producing countries or data mis-reported under an incorrect category of pulse crop. As a consequence, a real possibility is that some minor pulse crops may be lumped with a major pulse crop category for a given country. For example, common beans may be reported as cowpeas in West Africa or cowpeas may be reported as dry beans or other types of pulses in some countries (e.g., Brazil and India). There is no easy way to identify or fix these problems and anomalies in data series used in the analysis underlying this report; but where possible, the report tries to identify and flag these problems by relying on published sources and expert opinions of resource people with experience in these crops and/or regions (e.g., breeders and economists working at the international centers, NARS and university researchers).

Lastly, a caveat to note about food legume crops is that in many developing countries, these crops are inter-cropped with other food crops rather than grown as a sole crop. Thus, a one hectare of cowpea, for example, may have many other crops in the same field. This practice of inter-cropping which is common in legume crops in many parts of the developing world may lead to overestimation of area and underestimation of average yield when the total production is divided by 'total area' reported under a legume crop. There is no systematic analysis and reporting of the extent of inter-cropping practiced in different countries and we are not aware if the aggregated data reported by FAO or national statistical unit for the legume crops at the country level are adjusted for the practice of inter-cropping.

With these limitations and caveats in mind, we first present the global context and then proceed with the regional and global trend analysis of major food legume crops focused in this study--i.e., dry beans, cowpeas, pigeon peas, chick peas, faba beans, lentils and soybeans in West Africa. Trends in production, trade, utilization and consumption of these food legume crops are analyzed and results are summarized in tables and graphs. The Analysis is presented by themes--globally first for all pulse crops, then for the sub-set of focused crops, followed by analysis for each commodity.

2. Setting the Global Context

Pulses are important food crops due to their high protein and essential amino acid content. Table 2 compares the protein content of many important pulse crops and soybean with cereal crops. The seeds of pulse crops are typically made up of 20-25% protein compared to 6-10% protein content in major cereal crops. Pulses are also rich in dietary fiber and usually have only small amounts of oil. The protein of pulse seeds is high in the amino acids lysine and methionine, making pulses nutritionally complementary to cereals, which are deficient in these two essential amino acids. Pulses are the main source of protein in the diet of vegetarians, and feature prominently in the traditional cuisine of virtually every region of the globe. Moreover, in recent years there has been a change in the consumption of pulses in several developed countries where they are increasingly considered as health foods (Ipsos Reid, 2010; USDA-ERS, 2011).

On an average (unweighted by population) pulses contribute about 3% of total calories consumed in developing countries, ranging from 4% in SSA, 3% in SA and LAC, 2.5% in MENA and less than 1% in CA region (Figure1). Compared to cereal crops, this is relatively a small percentage from a global perspective (Figure 1). However, in some countries of SSA, pulses provide more than 10% of total calorie consumption per day—such as Niger (19%), Burundi (14%) and Rwanda (13%). Because of their higher protein content, pulses contribute relatively more towards total protein intake than calorie consumption. On an average (again, unweighted) pulse crops contribute 7.5% of total protein intake in developing countries as against 2.5% in developed countries (Figure 1). However, these averages mask the importance of pulse crops as a source of protein in many countries around the world. Table 3 lists 28 countries, mostly from SSA, but also from Asia and LAC where pulses contribute more than 10% of per

capita total protein intake of the country's population. As can be seen, many of these countries are among the poorest countries of the world. No wonder pulses are called 'the poor man's meat!'

Table 2: Kilo Calories and Protein Content of Major Pulse Crops, Soybeans and Cereal Crops

Crop category	Scientific name	Common name	Value per 100 grams	
			Kcal	Protein
Pulses	*Phaseolus vulgaris*	Black beans	333	23.58
		Kidney beans	341	21.60
		Pinto beans	347	21.42
	Vigna angularis	Adzuki beans	329	19.87
	Vigna radiata	Mung beans	347	23.86
	Vigna mungo	Black gram (Urad/Matpe beans)	341	25.21
	Phaseolus lunatus	Lima beans	335	20.62
	Vigna ungiculata	Cowpeas	336	23.52
	Vicia faba	Faba beans	341	26.12
	Cicer arietinum	Chickpea (Garbanzo)	364	19.30
	Lens culinaris	Lentils	353	25.80
	Cajanus cajan	Pigeon pea	343	21.70
Legume oil crop	*Glycine soja*	Soybeans	446	36.49
Cereals	*Triticum durum*	Wheat, durum	339	13.68
	Triticum aestivum	Wheat, bread	340	10.69
	Zea mays	Maize	365	9.42
	Oryza sativa	Rice, medium grain	360	6.61
	Pennisetum glaucum	Millet	378	11.02
	Sorghum	Sorghum	339	11.30
	Hordeum vulgare	Barley	352	9.91

Source: USDA National Nutrient Database (http://www.nal.usda.gov/fnic/foodcomp/search/)

Table 3. List of developing countries where pulses contribute more than 10% of per capita total protein intake (listed in descending order of percentage protein contribution by pulse crops)

Burundi	55%	Nicaragua	16%	Mauritania	13%	Dem. Rep. of Korea	11%
Rwanda	38%	Cuba	16%	Sierra Leone	13%	Guatemala	11%
Uganda	20%	Niger	15%	India	13%	Mexico	10%
Kenya	20%	Ethiopia	15%	Brazil	13%	Togo	10%
Comoros	18%	Malawi	15%	Trinidad and Tobago	12%	Belize	10%
Haiti	18%	Angola	15%	Mozambique	12%	Paraguay	10%
Eritrea	18%	Tanzania	14%	Cameroon	12%	Botswana	10%

Source: FAO (data for 2005-07)

Figure A3.1 in Annex 3 provides the spatial distribution of the intensity of harvested area devoted to dry beans and other pulses (as defined by FAO) around the globe. Pulse crops are grown in more than 100 countries covering more than 70 million ha of harvested area. They are especially an important category of food crops in South Asia, West Africa, East Africa, Central America and parts of South America.

Although pulses have many desirable characteristics in terms of nutrition and environmental benefits, in most countries of the world they are considered secondary crops. Globally, the harvested area under Pulse crops is about one-tenth the harvested area under all cereal crops (Figure 2). The area harvested under pulse crops has increased at a growth rate of 0.4% per year since mid-1990s, which compares positively

to almost a stagnant global trend in area growth rate for cereals, but still not enough to change its status from a secondary to a primary food crop.

Figure 1: Contribution of pulses relative to cereals and other food to total calorie and protein consumption in different regions of the DW, ROW and the world, 2005-07 (Source: FAO)

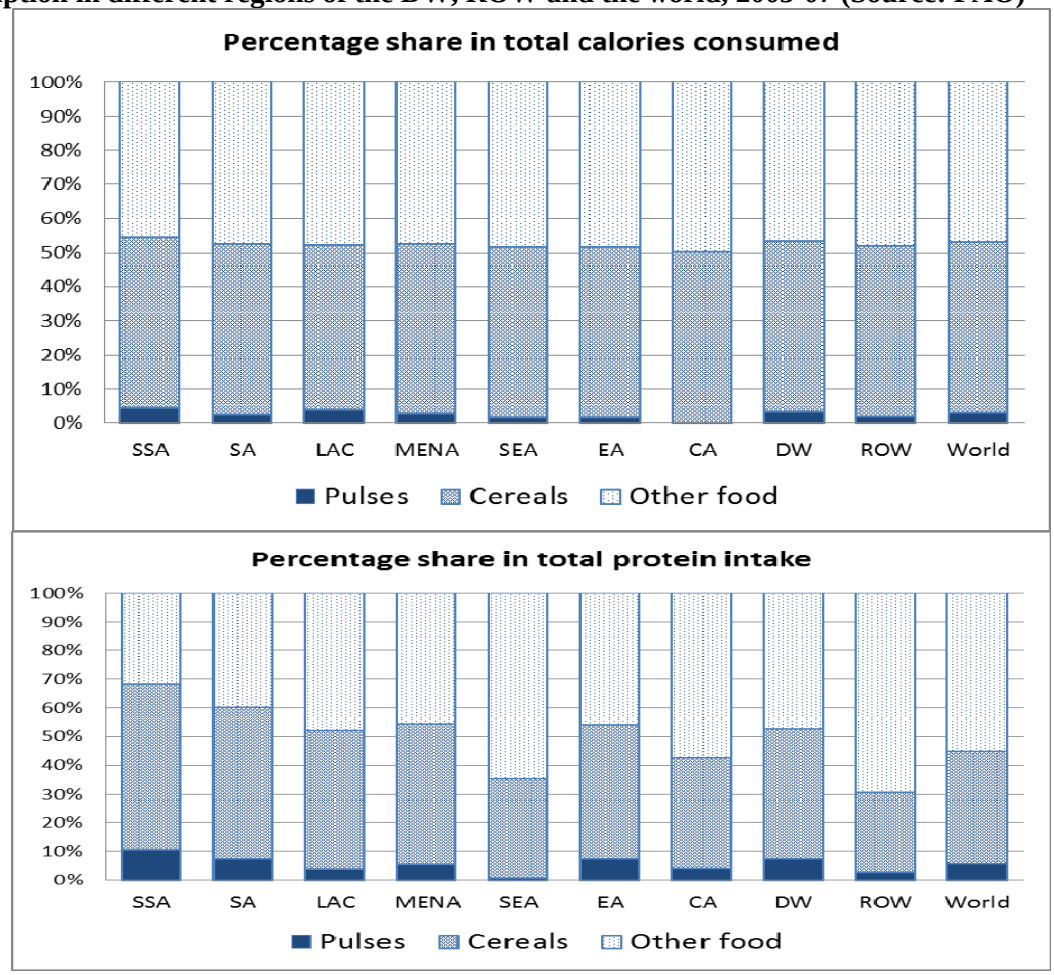
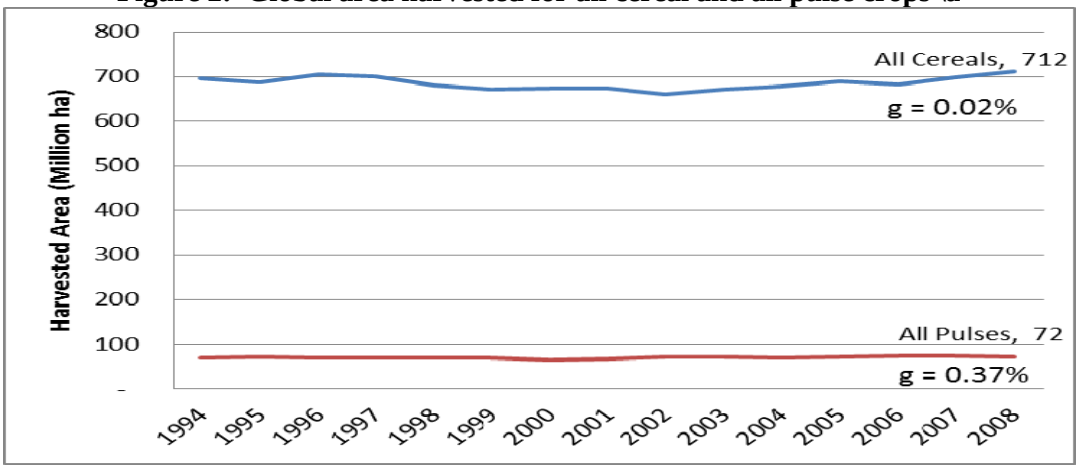


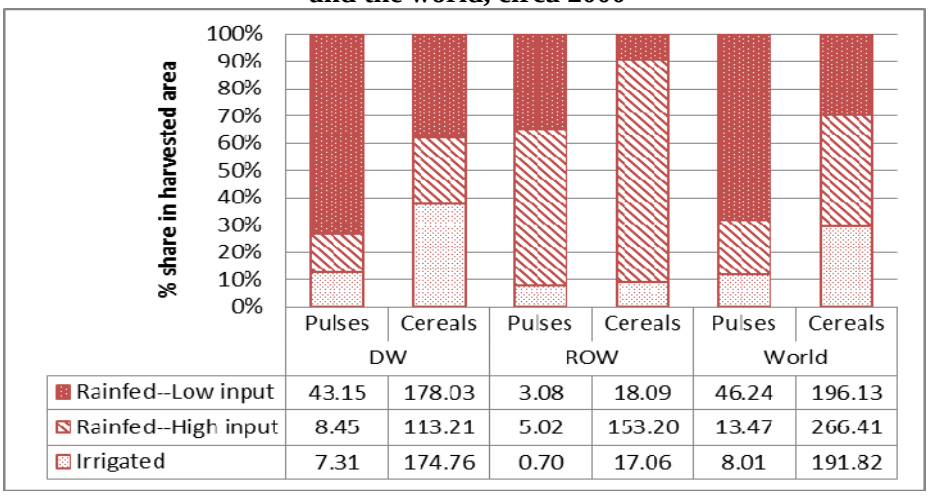
Figure 2: Global area harvested for all cereal and all pulse crops \a



Source: FAOSTAT (data refers to FAO category "cereals, total" and "pulses, total")

\a Includes the following additional pulses that are not focused by this study: Bambara beans, Lupins, Green peas, Pulses, nes, and Vetches.

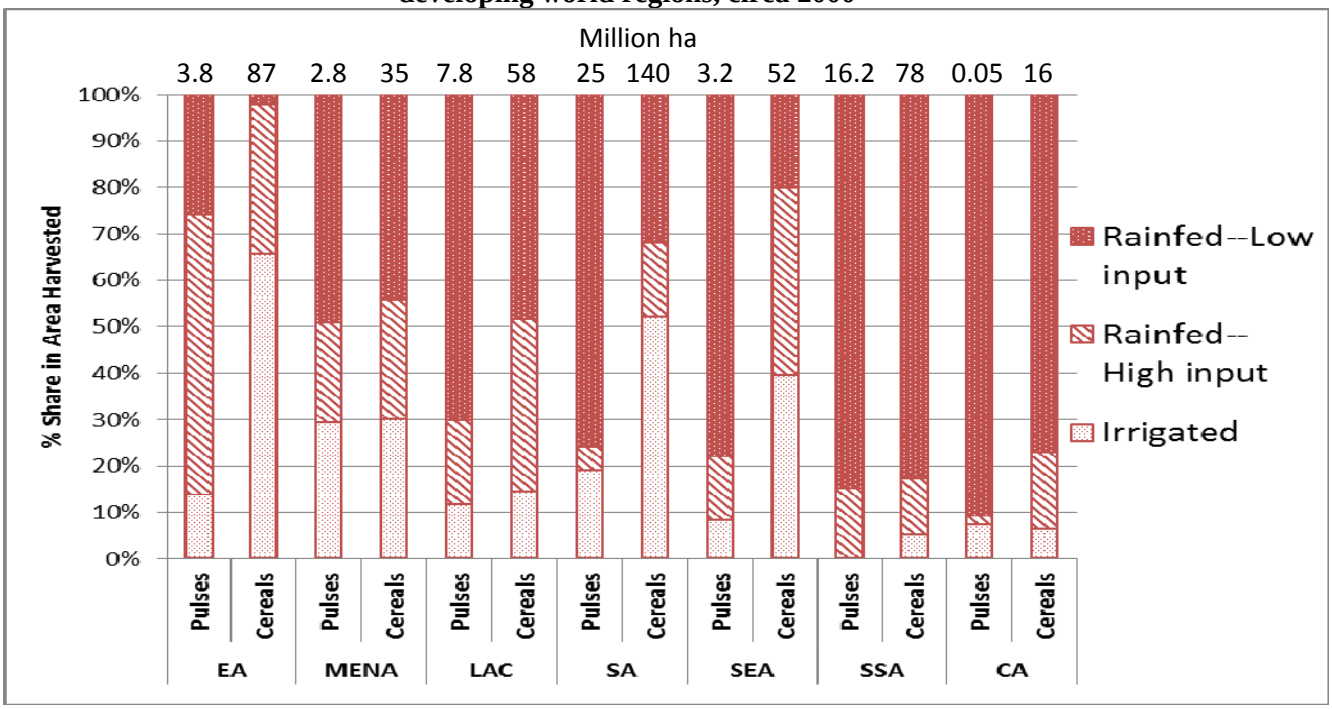
Figure 3: A comparison of proportion of total pulse and cereal harvested area (m ha) attributed to different production systems in the developing world (DW), rest of the world (ROW) and the world, circa 2000



	Pulses	Cereals	Pulses	Cereals	Pulses	Cereals
	DW		ROW		World	
Rainfed--Low input	43.15	178.03	3.08	18.09	46.24	196.13
Rainfed--High input	8.45	113.21	5.02	153.20	13.47	266.41
Irrigated	7.31	174.76	0.70	17.06	8.01	191.82

Source: HarvestChoice (SPAM database circa 2000)

Figure 4: Proportion of total pulse area harvested attributed to different production systems by developing world regions, circa 2000



Source: HarvestChoice (SPAM database circa 2000)

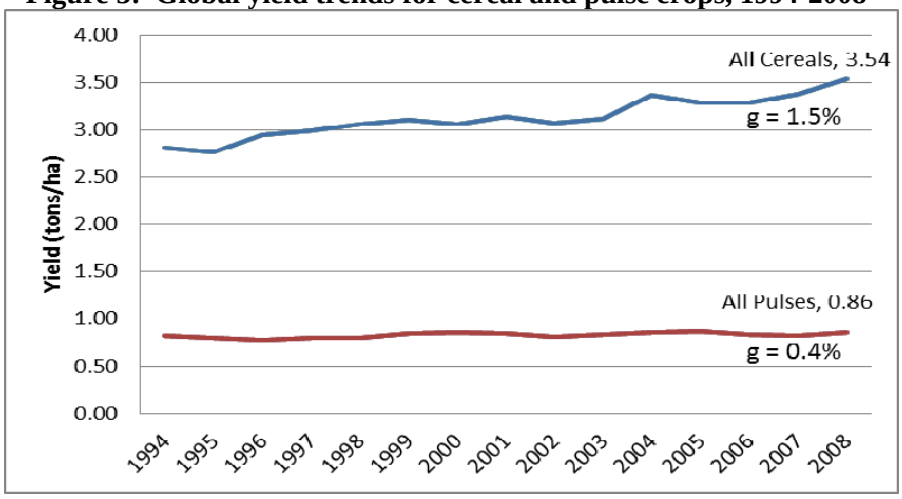
As a secondary crop category, pulses do not receive investment resources and policy attention from governments as do the cereal crops, which are often considered food security crops. Compared to cereal crops (i.e., wheat, maize, rice, barley, sorghum and millet), food legumes not only receive less quantity of land resources, but also other inputs. Also, compared to cereal crops, pulse crops are grown in marginal areas where water is a scarce resource. Figure 3 depicts a comparative picture of the relative importance of three production systems in pulse and cereal production in the developing world (DW), developed countries (ROW) and worldwide. In the developing world, only about 25% of total area is planted to high input rainfed or irrigated production systems compared to more than 60% for cereal crops. Even in

developed regions, the proportion of area harvested in rainfed-high input and irrigated system is much higher for cereal crops than for pulses. Worldwide, 70% of area harvested under all pulses falls under low-input rainfed systems compared to only 30% for cereals. The situation is worse than the global average in regions such as South Asia, Southeast Asia, Sub-Saharan Africa and Central Asia where more than 75% of pulse area harvested falls under rainfed-low input production systems (Figure 4). In all the developing regions, the relative share of irrigated and rainfed-high input systems is higher for cereal crops than for pulses. The disparity in the relative shares of the three production systems is highest in SA and SEA regions and lowest in SSA and MENA regions (Figure 4).

The result of the high proportion of pulse area harvested under rainfed-low input systems compared to cereal crops is that the average global yields of pulse crops (0.86 t/ha) is only about one-fourth the average yields of cereal crops (3.54 t/ha) (Figure 5). Globally, the average yields of pulses have increased only marginally from about 800 kg/ha to 840 kg/ha, representing a growth rate of 0.4%/year over the last 14 years. As against this, yields for cereal crops have increased at a rate of 1.5%/year or more than 500 kg/ha during the same time period.

Having set the global context of the nutritional value of pulse crops and the production systems in which pulses are grown, we now turn to the analysis of global and regional trends for a sub-set of pulse crops focused in this study.

Figure 5: Global yield trends for cereal and pulse crops, 1994-2008[7]



Data refers to FAO category "cereals, total" and "pulses, total")

3. Global and Regional Trend Analysis of Area, Production and Yield of Focused Crops

Table 4 gives a global picture of total food legume production by focused crops in the developing world (DW), rest of the world (ROW) and the world from 1994 to 2008. Commodity specific Tables on area harvested, production and yield by regions for two time periods – 1994-96 and 2006-08 are given in Annex 4. The world total[8] food legume area harvested under the focused crops stands at 61.5 m ha in 2006-08, which represents an increase of 10% from mid-1990s, and the total production in 2006-08 stands at 46.5 m tons, up by 24% from 1994-1996 level. The increase in global yield (12% or a growth

[7] Unless otherwise stated, the source for the data presented in graphs and Tables is FAOSTAT online datasets accessed from December 2010-March 2011.

[8] Includes only food legumes studied in this report. Cf. Table 1. Because of the different crops included in the global analysis presented in Section 2 and the analysis presented henceforth, the data and analyses are not strictly comparable.

rate of 1%/year)[9] has helped achieve this increase in production (Table 4). However, globally across all the seven focused crops, the average yield of food legume crops is barely 800 kg/ha in late 2000s. To put this in perspective, the average global yields of the six most important cereal crops in 2006-08 was 3.5 t/ha (ranging from 1.3 t/ha in Africa to 6 t/ha in North America) (FAOSTAT).

Table 4. Area, production and yield of major food legume crops in developing countries and worldwide, 1994-2008

	Developing World (DW)							Total		
	Dry	Faba	Chick	Cowpeas	Lentils	Pigeon	Soybeans	DW	ROW	WORLD
Area Harvested (million ha)										
1994-1996	24.66	2.04	10.59	8.22	2.94	4.12	0.58	53.15	2.47	55.62
2006-2008	26.67	2.05	10.41	11.36	2.7	4.73	0.67	58.59	2.89	61.48
Change in area	2.01	0.01	-0.18	3.14	-0.24	0.61	0.09	5.44	0.42	5.86
% Change	8.2%	0.5%	-1.7%	38.2%	-8.2%	14.8%	15.5%	10.2%	17.0%	10.5%
Growth rate (%/year)	0.66%	0.04%	-0.14%	2.73%	-0.71%	1.16%	1.21%	0.82%	1.32%	0.84%
Production (million tons)										
1994-96	15.06	3.06	7.82	2.75	2.23	2.82	0.27	34.01	3.5	37.51
2006-08	18.82	3.26	8.28	5.19	2.07	3.75	0.62	41.99	4.44	46.43
Change in production	3.76	0.20	0.46	2.44	-0.16	0.93	0.35	7.98	0.94	8.92
% Change	25.0%	6.5%	5.9%	88.7%	-7.2%	33.0%	129.6%	23.5%	26.9%	23.8%
Growth rate (%/year)	1.87%	0.53%	0.48%	5.44%	-0.62%	2.40%	7.17%	1.77%	2.00%	1.79%
Yield (tons/ha)										
1994-96	0.61	1.5	0.74	0.34	0.76	0.68	0.48	0.64	1.42	0.67
2006-08	0.71	1.59	0.79	0.46	0.77	0.79	0.93	0.72	1.54	0.76
Change in yield	0.09	0.09	0.05	0.12	0.01	0.11	0.45	0.08	0.12	0.08
% Change	15.5%	6.0%	6.8%	35.3%	1.3%	16.2%	93.8%	12.0%	8.4%	12.0%
Growth rate (%/year)	1.21%	0.49%	0.55%	2.55%	0.11%	1.26%	5.67%	0.95%	0.68%	0.95%

\a Only includes West Africa

The general trends in global food legume area harvested from 1994 to 2008 show a constant domination of dry beans over other crops (Figure 6). This is also evident in Figure 7 which shows the relative global importance of different food legumes in terms of area and production as observed in 2006-08. Dry beans cover 46% of total area under food legume crops focused in this study, followed by chickpeas and cowpeas, which each cover 18% of total area. In terms of production, dry beans still dominate at 46%, followed by chickpeas (22%). The share of all the other food legume crops focused in this study in global production is no more than 10% each (Figure 7).

Although, a couple of crops (viz., chickpeas and lentils) have seen a slight decline in area harvested over the last 15 years, the production of all the seven focused legume crops has increased in 2006-08 compared to 1994-06 (Figure 8). A special notice is to be given to soybean production in West Africa which has more than doubled (126%) between 1996-08 and 2006-08 (Table 4 and Figure 8), albeit it remains a very minor player in the world soybean production (less than one m tons of production). Next to soybean, cowpea has experienced the second highest increase in production over the past 15 years, increasing from 2.75 m tons in mid 1990s to more than 5 m tons in late 2000s (representing an 88% increase).

[9] Note that this is a much higher growth rate than observed for 'all pulses' in the same time period (see Figure 5), which implies that some of the pulses that are excluded from the analysis of this study (e.g., dry peas, Bambara beans, pulses, nes, vetches and lupins) must have experienced a negative or a less than average yield growth rate in the last 14 years.

Figure 6: Trend in world total food legume area harvested by crops, 1994-2008

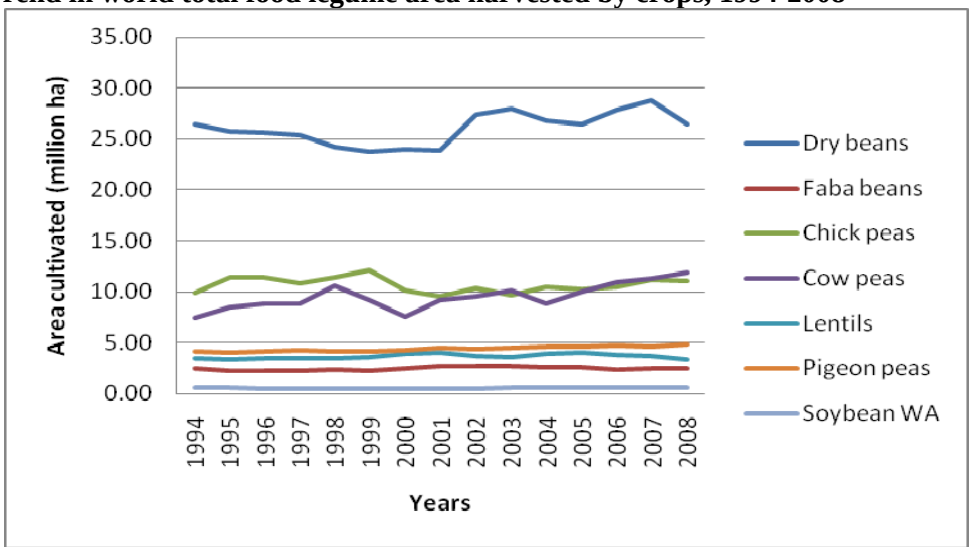
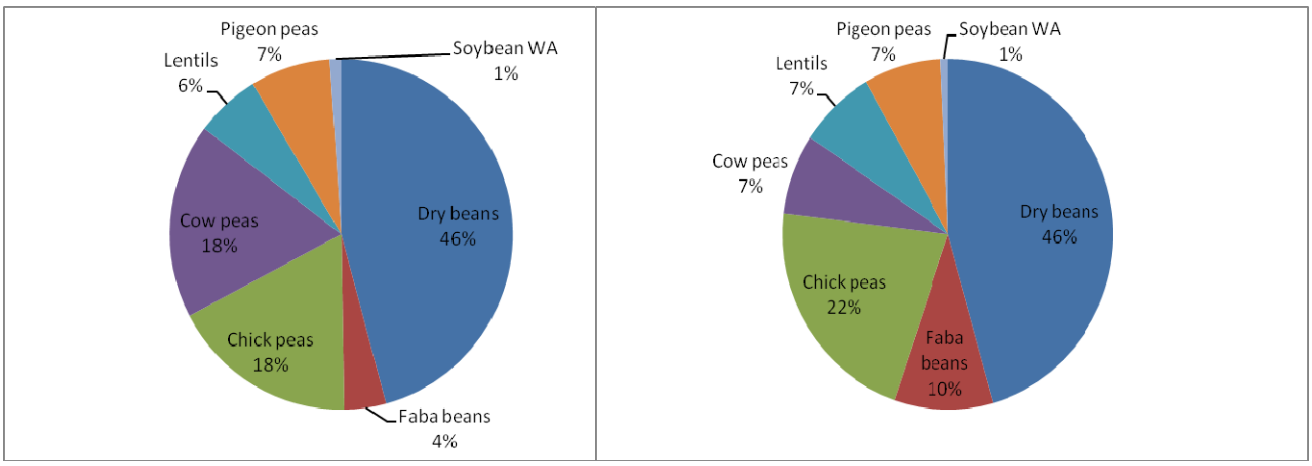


Figure 7: Shares of different legume crops in total global area and production, 2006-08



Total World **AREA** = 62 m ha

Total World **PRODUCTION** = 47 m tons

In terms of yield, according to FAO data, all food legume crops have seen increased yields in 2006-2008 compared to 1994-06 (Figure 9). Soybean yield in West Africa has experienced the most significant increase (96%), followed by cowpea (37%), pigeon pea (16%), dry bean (16%) and Faba bean (14%) (Table 4). Among the focused crops, cowpeas have the lowest yields per hectare. Faba bean is the only focused crop with an average global yields of more than one tons/ha, perhaps because it is mostly grown in high rainfall environments (Figure 9). The yields of these focused legume crops have increased at an average rate of 1%/year (Table 4). In the developing countries, the growth rate in average yields over the last 14 years range from a high of 5.8%/year for soybeans (only West Africa) to 0.5%/year for faba beans. Again, to put this in perspective, over the same time period (1994-96 to 2006-08), the yields of cereal crops worldwide increased at a rate of 2.5%/year-significantly higher than the 1%/year average growth rate in yields observed for the food legume crops.

Figure 10 shows how the trends in average yields across all seven focused crops in the developing countries compare with the trends in average yields of the food legume crops in ROW and the world in the last 14 years. At an aggregate level, the yields across all the focused crops in the developing world is

not only significantly lower (almost half) than in the yields in the developed world (or ROW), but also exhibits (surprisingly) less fluctuations than ROW (Figure 10). The lagging of pulse productivity in developing countries can be explained by several factors, including: i) low input use: Pulse production in most developing countries remains a low-input system based on very limited or no use of fertilizer or chemical inputs, and is characterized by small-scale subsistence production system (Figures 3 and 4); ii) Pulses are being increasingly pushed into marginal areas: The expansion of irrigated land has pushed pulses into marginal zones with the better land used to grow high yielding varieties of cereals (Rao et al. 2010; Mubarik Ali, 1998; FAO 1994); iii) Adverse policy effects: Agricultural policy in developing countries has focused on cereals for food security purposes, which often relegates pulses to a secondary or tertiary status, thus receiving less investment resources from the government (Byerlee and White 2000); and iv) Limited research and lack of technology dissemination system to deliver new technology and improved-cultivars to farmers (BenBelhassen 2006).

Figure 8: World food legume production by crops 1994-06 and 2006-08

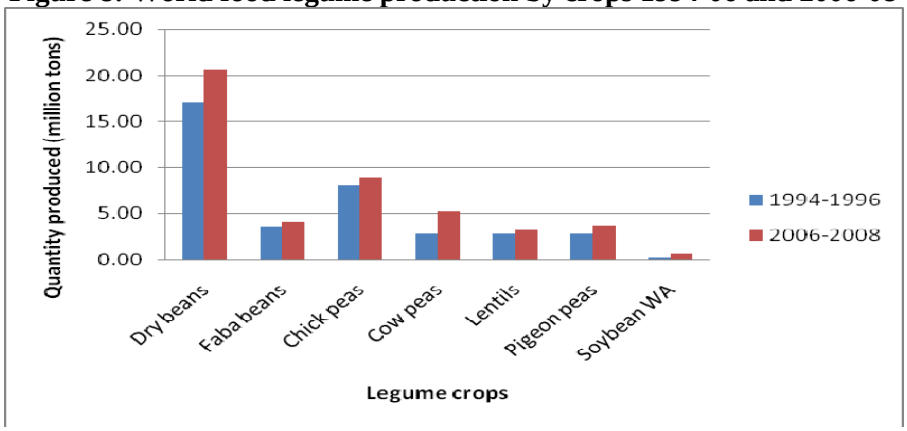
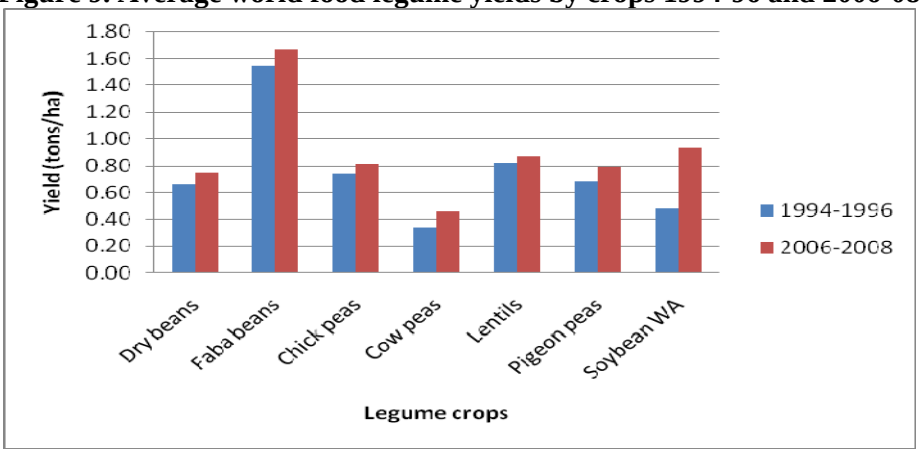
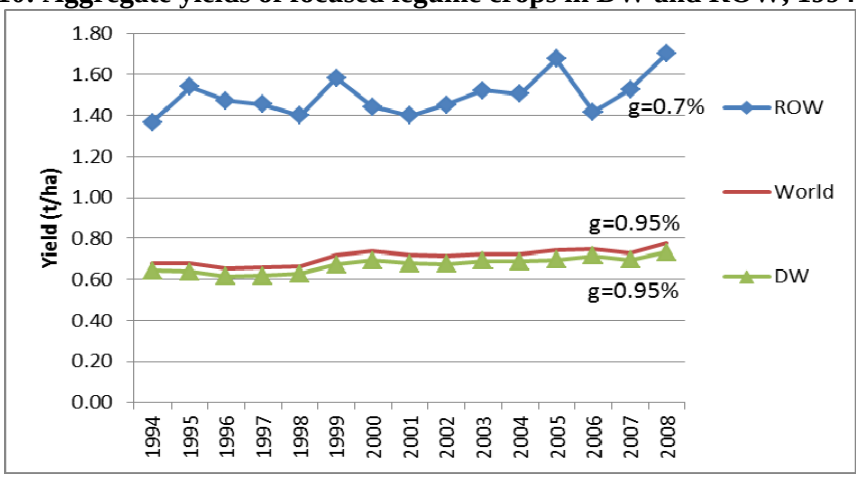


Figure 9. Average world food legume yields by crops 1994-96 and 2006-08



Food legume area cultivated and production in ROW (which is mostly comprised of developed countries in North America, Europe, Australia, New Zealand and Japan) have stayed relatively low over the last 15 years, capturing about 4% of global area harvested and 9% of total production of the seven focused crops (Table 4). This indicates that these legumes (except for soybean) remain mostly the food crops of the developing world.

Figure 10: Aggregate yields of focused legume crops in DW and ROW, 1994-2008 \a



\a DW=Developing world; ROW=rest of the world

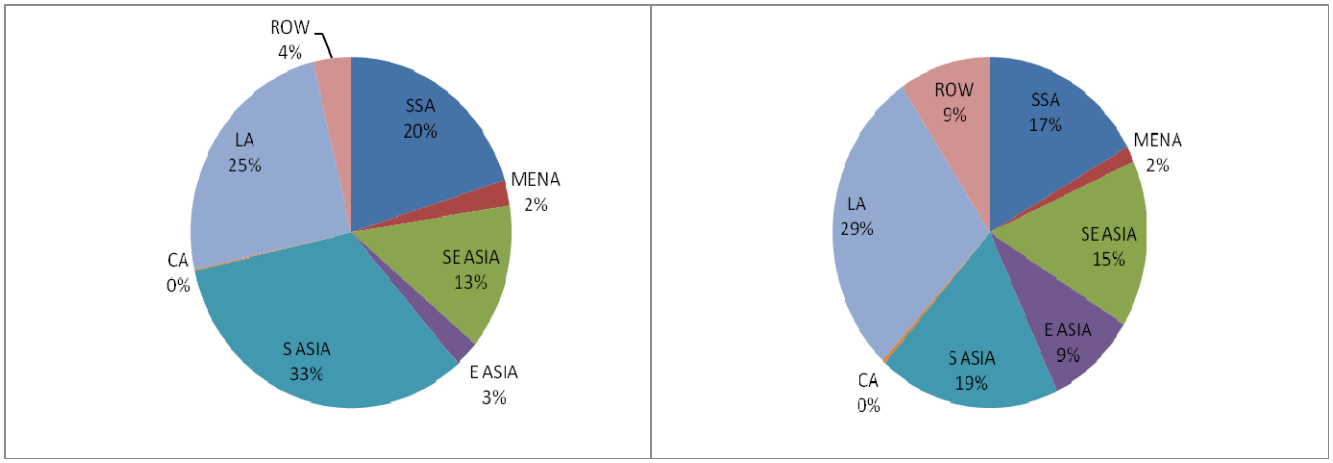
We now examine the regional and country level trends in area, production and yield by each commodity.

3.1. Dry bean area, production and yield trends

Table A4.1 (in Annex 4) provides the regional breakdown of the area, production and yield of dry beans in the two periods—1994-96 and 2006-08. In 2006-08, the total global dry bean[10] area harvested was 28 m ha—96% of which was in the developing world and 4% in the developed world (Figure 11). South Asia has the largest share of dry bean area (33%), followed by LAC (25%), SSA (20%) and Southeast Asia (13%). In terms of production, LAC region has the largest share (29%) followed by South Asia (Figure 11).

Total dry bean area cultivated in the DW was 27 million ha in 2006-08 as against 25 million ha in 1994-06 (Figure 12). All the regions have seen an increase in area harvested in dry beans except for LAC, E Asia and ROW. In terms of production, total dry bean quantity produced in the world has grown from 17 million tons in 1994-06 to 21 million tons in 2006-08. That represents an increase of 21% compared to only a 6% increase in area harvested (Table A4.1).

Figure 11. Shares in world dry bean area and production by regions, 2006-08



World dry bean **AREA** harvested = 27 m ha

World dry bean **PRODUCTION** = 21 m tons

[10] Note that 'dry beans' include all types of '*Phaseolus*' beans and do not correspond with 'common beans' as such.

Figure 12. Dry bean area harvested in 1994-06 and 2006-08 by regions

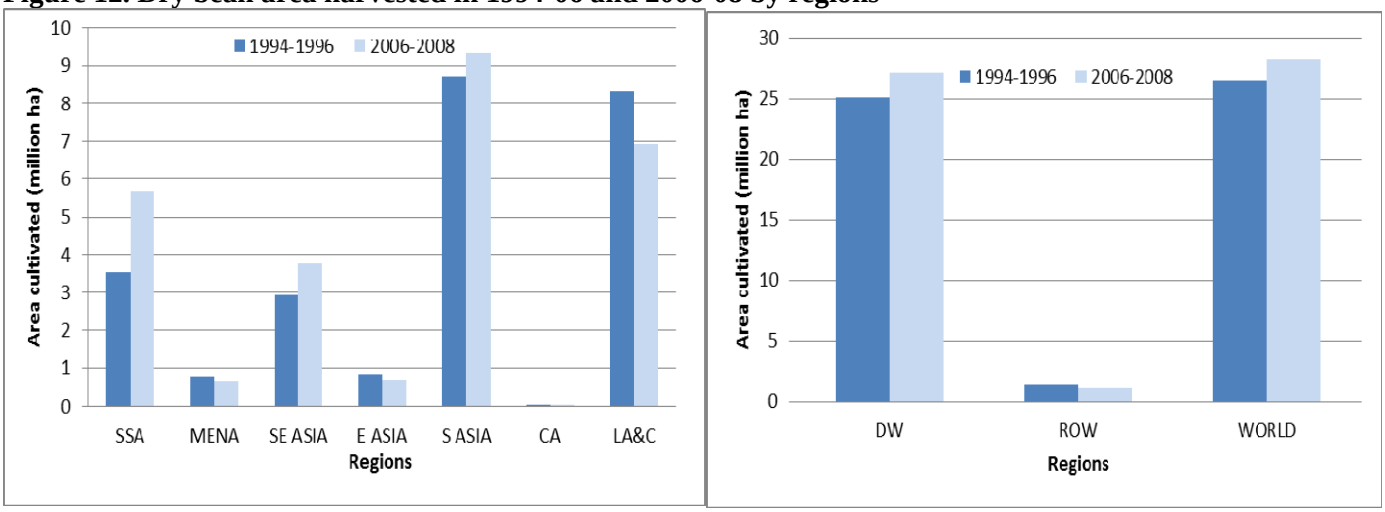


Figure 13. Total production of dry bean in 1994-06 and 2006-08 by regions

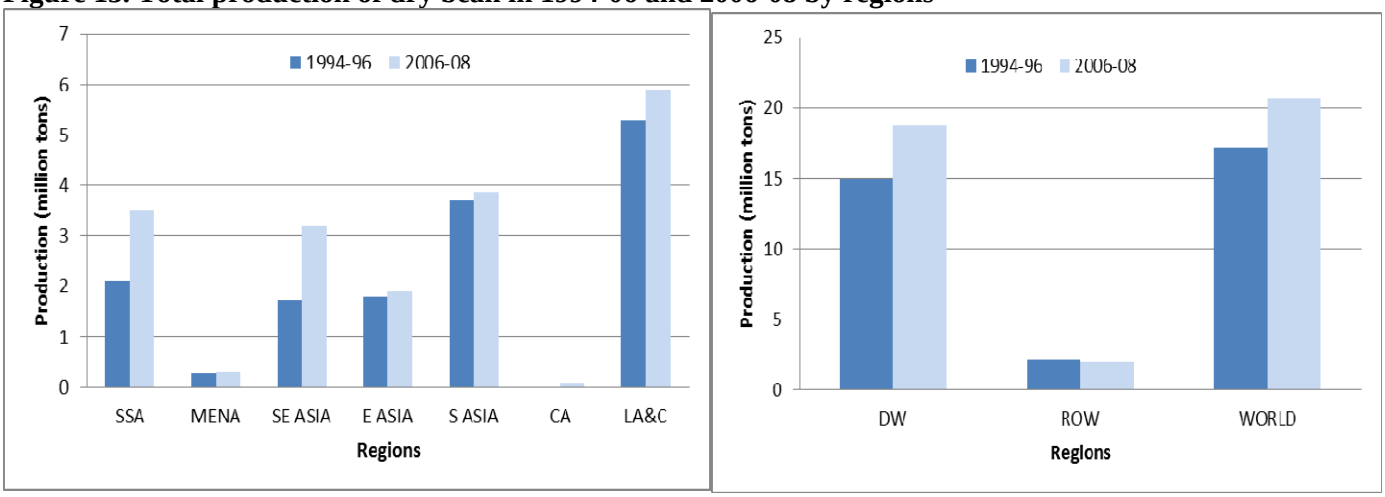
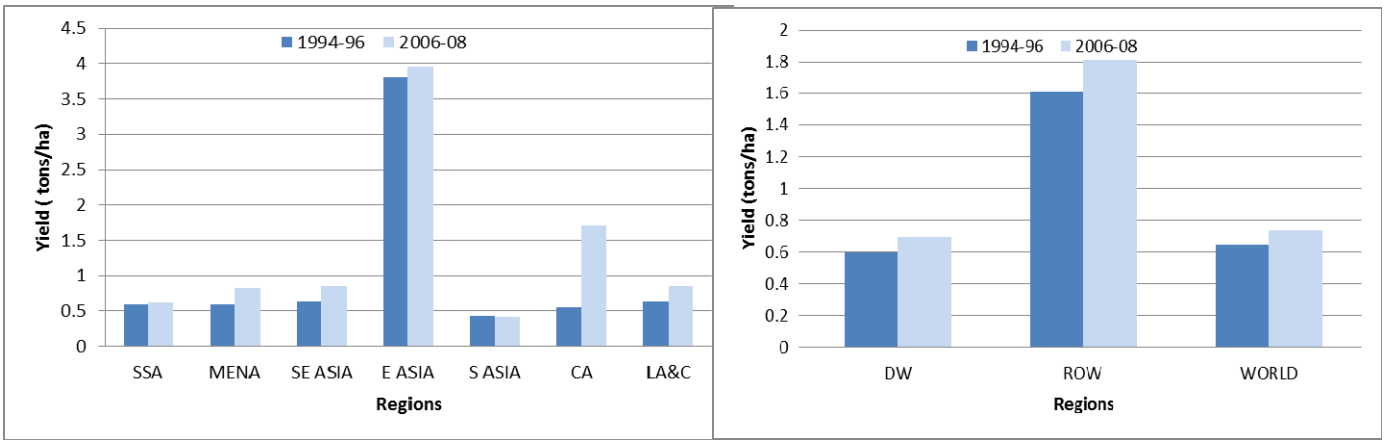


Figure 14. Dry bean yields by regions in 1994-06 and 2006-08



Changes in production and yields for all regions including the Developing World (as a whole) and ROW are shown on Figures 13 and 14. The Central Asia and MENA regions remain insignificant players in world dry bean production. Although, LAC has lost 17% of dry bean area cultivated, its production has increased about 12%. SSA and SE ASIA have achieved respectively two-third (67%) and a four-fifth increase (85%) in production. World dry bean yield has increased about 14% or at an annual rate of 1.08% in the last 14 years (Table A4.1). The highest yields are observed in E ASIA (more than double the yields in other regions), but it is not a major dry bean producing region. The two major dry bean producing regions—S Asia and SSA have experienced insignificant change in average yields over the last 14 years (Figure 14).

Table 5 ranks the top 20 developing country growers of dry beans (all types of *Phaseolus* beans) in terms of area harvested. India is on the top of this list and makes up 32% of the world total dry bean area and 95% of dry bean area in S ASIA in 2006-08. Brazil, the second largest producer represents 14% of the world total area harvested and more than half (55%) of Latin American and Caribbean region's dry bean area. These two top producers are followed by Myanmar (9%), Mexico (6%), Tanzania (4%) and China (4%) (Table 5). These top six countries cover almost two-thirds of the total area under *Phaseolus* beans. Beyond these top 6 growers, area harvested under dry beans is spread across many small producing countries in Asia, SSA and LAC with a share in total world dry bean area ranging from 3% to less than 1% (Table 5).

Table 5. Top Dry Bean Producers in the Developing World as Defined by Area Harvested

	Countries	Average Area harvested 2006-08 (million ha)	Percent share in area harvested 2006-08	Cumul. percent share 2006-08	Average Production 2006-08 (million tons)	Average Yield 2006-08 (million tons)
1	India	8.85	31.94	31.94	3.40	0.38
2	Brazil	3.87	13.96	45.91	3.36	0.87
3	Myanmar	2.36	8.54	54.44	2.50	1.06
4	Mexico	1.57	5.68	60.12	1.17	0.74
5	United Republic of Tanzania	1.20	4.33	64.45	0.85	0.71
6	China	0.98	3.55	68.00	1.60	1.63
7	Uganda	0.87	3.15	71.15	0.43	0.50
8	Kenya	0.83	2.99	74.13	0.41	0.49
9	Rwanda	0.40	1.45	77.76	0.31	0.76
10	Angola	0.39	1.40	79.16	0.11	0.28
11	Dem. People's Rep. of Korea	0.35	1.26	80.42	0.30	0.86
12	Indonesia	0.31	1.12	81.54	0.32	1.04
13	Cameroon	0.28	1.01	82.55	0.25	0.89
14	Pakistan	0.26	0.93	83.49	0.17	0.67
15	Malawi	0.25	0.92	84.41	0.12	0.49
16	Argentina	0.25	0.89	85.30	0.33	1.33
17	Nicaragua	0.23	0.84	86.14	0.18	0.75
18	Burundi	0.23	0.83	86.97	0.21	0.90
19	Dem. Republic of the Congo	0.21	0.75	87.72	0.11	0.54
20	Ethiopia	0.21	0.74	88.46	0.20	0.97

The composition of and the importance of *Phaseolus* beans grown in these top dry bean producing countries is different. In Table 6, we present the "back of the envelope" calculations based on country level data reported in published and unpublished reports to disaggregate the dry bean area reported by FAOSTAT for some of the top dry bean producing countries into area under common beans and all other types of dry beans. Although, these do not represent 'official' data, it is safe to say that Brazil, followed by Mexico, are the world's first and second largest common bean (*Ph. vulgaris)* producing countries in

the developing world. Also, it is safe to say that in top Asian countries in the list, other types of dry beans are relatively more important than common beans. For example, in India, Myanmar, and Pakistan, black gram (urad) (*Vigna mungo*), mung beans (*Vigna radiata*), and moth beans (*Vigna aconitifolius)* are of major importance (see Annex 2 for the breakdown of pulse data for India). In China, mung beans are a major type of dry beans followed by *Ph. vulgaris* (common bean). In all the other countries in SSA and LAC *Ph. vulgaris* (common bean) is the most important (and may be the only type of dry bean produced). But given the large share of India, Brazil, Myanmar and China in global dry bean production, half of the area harvested under dry bean as reported by FAOSTAT corresponds to common beans and half to other types of dry beans, with mung beans perhaps having the largest share of this other half, followed closely by black gram (urad).

Table 6: Disaggregation of area harvested under dry bean category into area under common bean and other types of beans in top 20 developing country producers of dry beans, 2006-08

		Average Area harvested 2006-08 (million ha)			
Crop--->		**Dry bean**	**Common bean**	**Other types of dry beans**	Major types of other pulses included as "dry beans" in FAOSTAT data
Source---->		FAOSTAT	Country level data from published and unpublished reports / presentations \a		
1	India	8.85	0.59	8.26	Black gram, Mung beans, Moth beans and Cowpea
2	Brazil	3.87	3.40	0.47	Cowpea
3	Myanmar	2.36	0.13	2.23	Black gram, Mung beans
4	Mexico	1.57	1.57	0	
5	Tanzania	1.20	1.20	0	
6	China	0.98	0.43	0.55	Mung beans
7	Uganda	0.87	0.87	0	
8	Kenya	0.83	0.83	0	
9	Rwanda	0.40	0.40	0	
10	Angola	0.39	0.39	0	
11	Dem. People's Rep. of Korea	0.35	0.35	0	
12	Indonesia	0.31	0.31	0	
13	Cameroon	0.28	0.28	0	
14	Pakistan	0.26	0	0.26	Black gram, Mung beans, Moth beans and Cowpea
15	Malawi	0.25	0.25	0	
16	Argentina	0.25	0.25	0	
17	Nicaragua	0.23	0.23	0	
18	Burundi	0.23	0.23	0	
19	D. Rep. of Congo	0.21	0.21	0	
20	Ethiopia	0.21	0.21	0	
Total for top 20		23.90	12.14	11.76	

\a Source: Authors' calculations based on following country-specific sources: For India: Directorate of Economics and Statistics, Ministry of Agriculture, New Delhi; For Brazil: Chiorato et al. (2008) and USDA/FAS (2010) GAIN Report #BR0627; For Myanmar, crude estimates based on export data from Bangar (2009) presentation available at http://www.cicilsiptic.org/fileadmin/Document/Antalya_2009/Sunday_11_Bangar.ppt; For China: Global Times (2010) http://business.globaltimes.cn/comment/2010-07/555201.html; For Pakistan: crude estimates based on production data from Majeed's (2009) presentation available at http://www.cicilsiptic.org/fileadmin/Document/Antalya_2009/Sunday_10_Majeed.ppt

In terms of trends in dry bean area harvested, the top two Latin American countries (Brazil and Mexico) have seen a decline in area harvested over the last 14 years (Figure 15). The highest percentage increase in dry bean area in the past 14 years has been in Myanmar and Tanzania. Myanmar has also experienced the highest yield growth in dry beans (Figure 16). In fact, as shown in Figure 16, according to FAO data all five top dry bean growers, except for India, have seen an increase in yields in the past 14 years. The coefficient of variation (CV) of yield trends from 1994 to 2008 in these top five dry bean producing countries range from 0.10 in Mexico to 0.17 in India and Myanmar, which compared to some other pulses (noted below) exhibits relative stability in temporal yield variability.

Figure 15. Dry bean area harvested by top 5 growing countries in 1994-96 and 2006-08

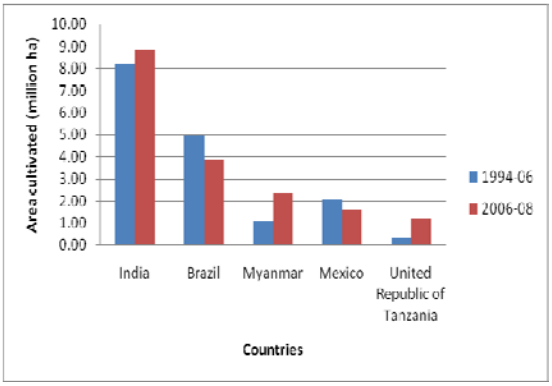
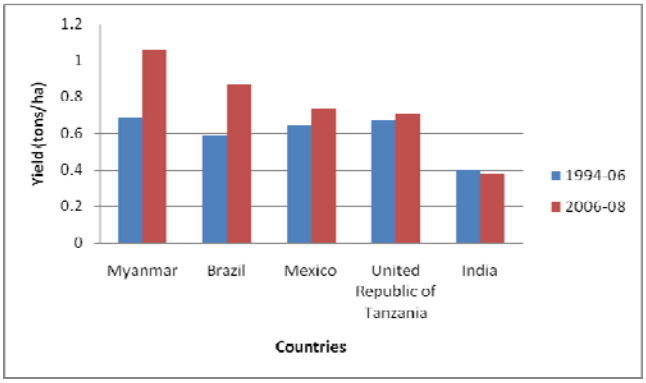


Figure 16. Dry bean yields in top 5 growing countries 1994-96 and 2006-08



3.2. Chickpea area, production and yield trends

Chickpea, also known as the Bengal gram (or simply gram) and garbanzo beans (*Cicer arietinum*) are the second most important food legume crops in the world grown on 11 million ha worldwide with a total production of 9 million tons in 2006-08 (Table A4.2).[11] South Asia[12] is by far the largest producer of chickpea (76%) in the world with a share of more than 80% of area harvested (Figure 17). Like dry beans, the developing world's share in total area and production of chickpea is 95% and 93% respectively. The region of Middle East and North Africa (MENA) is the second most important region for chickpea area and production followed by SSA. The SE Asia and LAC as a region have more than 100 thousand ha of chickpea, but are relatively insignificant players from the global perspective.

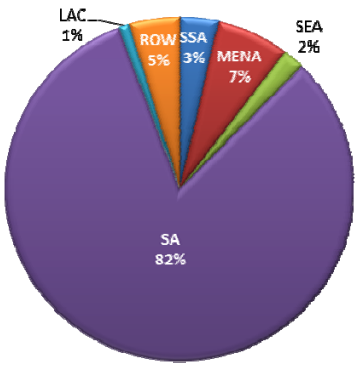
The regions that have seen a substantial increase in area harvested under chickpea in the last 14 years include the SE Asia region (by 67%) and the developed countries (ROW) (by 48%). Over the same period the area also increased 18% in SSA and marginally in South Asia (less than 1%). Both the LAC and MENA regions have seen declining area and production of chickpea in the last 14 years (Table A4.2).

World chickpea yields have increased by 10% from 1994-96 to 2006-08. Yields in South Asia—the leading producer of chickpea, increased by 5% in the same period. In MENA, the next important chickpea producing region, yields declined by 2% (Table A4.2). The region of South East Asia saw chickpea yields double in the last 14 years from 0.6 tons/ha to 1.2 tons/ha.

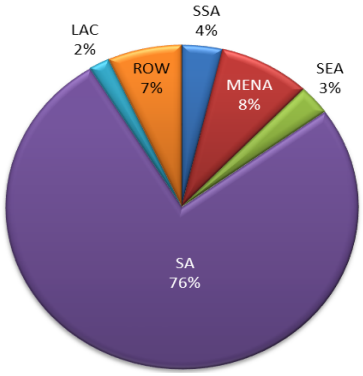
[11] In terms of area harvested, cowpea would be the second most important food legume crop after dry beans. Also, if cowpea area in India and Brazil are included in the official FAOSTAT data, cowpea would be also the second most important food legume crop in terms of production.

[12] Note that according to FAO definition, South Asia region includes Iran, which is a major chickpea producing country.

Figure 17. Shares in world chickpea area and production by regions, 2006-08



World Chickpea **AREA** harvested = 10.9 m ha



World Chickpea **PRODUCTION** = 8.9 m tons

India is by far the largest chickpea growing country in the world. The two South Asian countries—India and Pakistan, together cover more than 75% of total world chickpea area (Table 7). The other top chickpea growing countries from the developing world include Iran and Turkey (5% share in world chickpea area each), and Myanmar and Ethiopia (2% share each). Mexico ranks next with about one million ha followed by many other small producers with less than million hectares (and less than 1% share in world chickpea area) (Table 7).

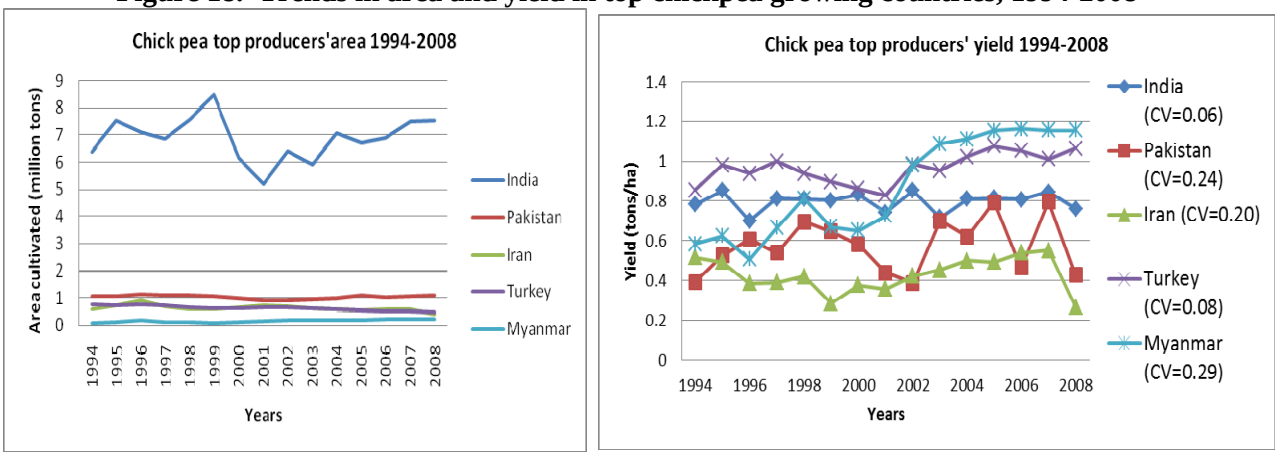
Table 7. Top Chickpea Producing Developing Countries Ranked by Area Harvested, 2006-08 \a

	countries	Average Area harvested 2006-08 (million ha)	Percent share in area harvested 2006-08	Cumul. percent share 2006-08	Average Production 2006-08 (million tons)	Average Yield 2006-08 (tons/ha)
1	India	7.31	66.96	66.96	5.89	0.81
2	Pakistan	1.06	9.73	76.69	0.60	0.56
3	Iran (Islamic Republic of)	0.54	4.96	81.65	0.26	0.47
4	Turkey	0.50	4.61	86.26	0.53	1.04
5	Myanmar	0.22	2.06	88.32	0.26	1.16
6	Ethiopia	0.21	1.92	90.24	0.25	1.20
7	Mexico	0.10	0.90	91.14	0.16	1.62
8	Malawi	0.09	0.87	92.00	0.04	0.40
9	Syrian Arab Republic	0.07	0.68	92.69	0.04	0.58
10	Morocco	0.07	0.67	93.35	0.05	0.63
11	United Republic of Tanzania	0.07	0.64	93.99	0.03	0.44
12	Yemen	0.02	0.20	94.20	0.06	2.61
13	Algeria	0.02	0.19	94.39	0.01	0.61
14	Bangladesh	0.01	0.11	94.49	0.01	0.78
15	Tunisia	0.01	0.10	94.59	0.01	0.99
16	Iraq	0.01	0.10	94.69	0.01	0.69
17	Nepal	0.01	0.09	94.78	0.01	0.81
18	Eritrea	0.01	0.07	94.85	0.00	0.61
19	Sudan	0.01	0.06	94.91	0.01	1.92
20	Kazakhstan	0.01	0.06	94.97	0.01	0.87

\a Does not include developed countries which are major chickpea growing countries (e.g., Australia with 0.3 m ha and Canada with 0.11 m ha).

Figure 18 focuses on the trends in chickpea area harvested and production per hectare observed in the top five chickpea growing countries in the world. Overall, the trend in area harvested in these top five countries seem to be stable, except in India where the area harvested peaked to more than 8 m ha in late 1990s and than declined dramatically in early 2000s. It has since steadily increased and was about 7.5 m ha in 2008 (Figure 18). Unlike the steady trend in area over the past 14 years, yields have seen more fluctuations in all the countries. The CVs of the yield trend from 1994-2008 range from 0.06 in India to a high of 0.24 in Pakistan and 0.29 in Myanmar (Table 18). Yields have steadily increased in Turkey, almost doubled in Myanmar, and declined in Iran. The divergence in yield levels in top five chickpea growing countries appears to be increasing in recent years (Figure 18).

Figure 18. Trends in area and yield in top chickpea growing countries, 1994-2008



3.3. Cowpea area, production and yield trends

Cowpeas, a native crop of West Africa, are one of the most important food legume crops now grown in the semi-arid tropics covering Asia, Africa, southern Europe and Central and South America. A drought-tolerant and warm-weather crop, cowpeas are well-adapted to the drier regions of the tropics, where other food legumes do not perform well. In terms of area harvested, cowpeas are the second most important food legume crops in the world. According to FAO data, cowpeas are grown on 11.4 million ha worldwide; 97% (or 11 m ha) of which is grown in SSA (Table A4.3). A caveat to be noted about the cowpea data from FAO is that it does not include any cowpea area in Brazil and India, which according to cowpea experts and unofficial data reported in Table 5 are also important cowpea growing and producing countries in the world. Based on the disaggregated data reported in Table 5, we estimate that these two countries together harvest cowpeas on at least one million ha of land.[13] At this magnitude, both these countries will be among the top five cowpea producing countries in the world. Thus, at the outset, it is important to note this limitation of the FAO data on which the analysis is based, that it excludes Brazil and India.

Total cowpea area harvested has risen by 38% between 1994-06 and 2006-08. World cowpea production has increased 88% and yields have increased by 35% in the same time period. This increase in area, production and yield has been made possible by a similar trend in SSA, which dominates the world scene (Table A4.3). Despite the dramatic increase in production in SSA, cowpea yields remain one of the lowest among all food legume crops, averaging at 450 kg/ha in 2006-08, which is half of the estimated yields in

[13] Back of the envelope estimates by the authors puts harvested cowpea area in India at 0.59 million ha and in Brazil at 0.46 million ha in 2006-08.

all other developing regions. In comparison, cowpea yields in developed countries are estimated at 2.4 tons/ha (Table A4.3).

Not accounting for India and Brazil, the top five cowpea growing countries are all in West Africa. Nigeria and Niger have maintained the top first or second position over the past 14 years, together covering more than 80% of total cowpea area in the world (Table 8 and Figure 19). Other important cowpea growing countries include Burkina Faso (6%), Mali (2%) and Senegal (2%). These five West African countries share more than 90% of the world cowpea area harvested in 2006-08. While area cultivated has stayed stable in Burkina Faso, Mali and Senegal over the last 14 years; it has fluctuated significantly in Niger and Nigeria with drops and increments at the scale of more than 1 million ha (Figure 19).

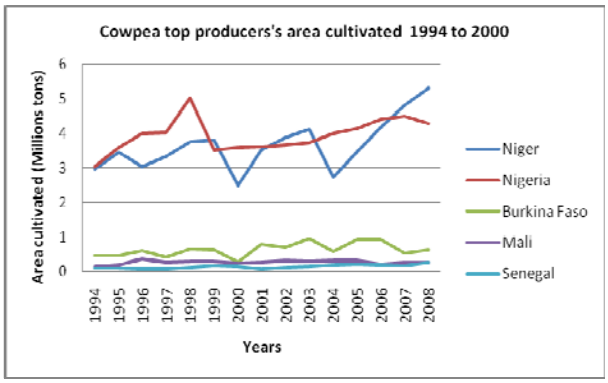
The average yields in Nigeria have steadily increased since mid-1990s and have reached around 700 kg/ha in recent years (Figure 19). Compared to Nigeria, all the other top cowpea growing countries in West Africa have significantly lower yields (almost by 200-300 kg/ha). Except, for Nigeria and Niger, these countries have either experienced a decline in average yields or yields have remained stagnant over the past 14 years (Figure 19).

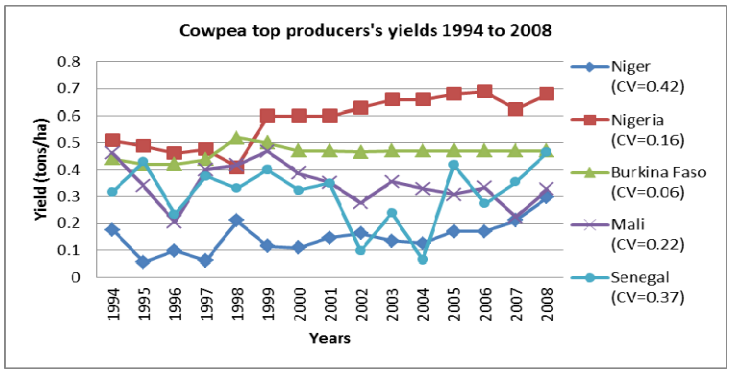
Table 8. Top Cowpea Producing Developing Countries Ranked by Area Harvested, 2006-08 \a

	countries	Average Area harvested 2006-08 (million ha)	Percent share in area harvested 2006-08	Cumul. percent share 2006-08	Average Production 2006-08 (million tons)	Average Yield 2006-08 (tons/ha)
1	Niger	4.76	41.80	41.80	1.10	0.23
2	Nigeria	4.40	38.63	80.43	2.92	0.66
3	Burkina Faso	0.70	6.17	86.60	0.33	0.47
4	Mali	0.25	2.16	88.75	0.07	0.29
5	Senegal	0.21	1.86	90.61	0.08	0.38
6	Myanmar	0.15	1.33	91.95	0.15	0.98
7	United Rep. of Tanzania	0.15	1.32	93.27	0.06	0.38
8	Kenya	0.15	1.29	94.56	0.07	0.50
9	Dem. Rep of the Congo	0.12	1.02	95.57	0.06	0.48
10	Sudan	0.11	0.96	96.54	0.03	0.31
11	Cameroon	0.11	0.92	97.46	0.10	0.98
12	Malawi	0.08	0.70	98.16	0.05	0.69
13	Uganda	0.07	0.64	98.80	0.08	1.04
14	Haiti	0.04	0.37	99.17	0.03	0.70
15	Mauritania	0.02	0.20	99.37	0.01	0.35

\a Source: FAOSTAT (note the FAOSTAT does not provide any area, production data for cowpeas in Brazil and India, hence they do not appear on this list).

Figure 19. Trends in area and yield in top cowpea growing countries, 1994-2008




Cowpea top producers's yields 1994 to 2008
Yield (tons/ha)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Years
Niger (CV=0.42)
Nigeria (CV=0.16)
Burkina Faso (CV=0.06)
Mali (CV=0.22)
Senegal (CV=0.37)

3.4. Pigeon pea area, production and yield trends

Pigeon pea (*Cajanus cajan)*, also known as toor daal (in India), Congo pea or gungo pea (in Jamaica), Pois Congo (in Haiti), gandul (in Puerto Rico), gunga pea, or no-eye pea, is an important legume crop of rainfed agriculture in the semi-arid tropics. The Indian sub-continent, Eastern Africa and Central America/Caribbean region, are the world's main pigeon pea producing regions. Pigeon peas are cultivated either as a sole crop or intermixed with cereals or other legumes, such as groundnuts. Total worldwide area harvested under pigeon pea has increased by 15% from 4.12 m ha in 1994-96 to 4.73 m ha in 2006-08. Table A4.4 (in Annex 4) provides statistics on regional distribution of pigeon pea area, production and yield for the two time periods and changes in those series over the last 14 years. Unlike other pulse crops focused in this study, pigeon pea is only grown in the developing world.

Overall, yield of pigeon pea has increased by 16% and production by 33% (Table A4.4). South Asia region leads area harvested with 77% share, followed by SSA (11%) and SEA (11%) (Figure 20). SA has increased pigeon pea area by 5%, SSA by 35% and SEA by 139% over the last 14 years. Production has increased by 14% in SA, 68% in SSA and 324% for SEA. Increases in yields have not been significant in these three regions.

Table 9 presents the list of major pigeon pea producing countries ranked by area harvested in 2006-08. Not surprisingly, countries from the Indian sub-continent, East Africa and the Caribbean region dominate the top 10 list. India is by far the largest single pigeon pea growing country with more than three-quarters of the world pigeon pea area harvested. Its neighboring countries, Myanmar ranks second (11%), followed by countries in East and Southern Africa—Kenya (4%), Uganda (3%), Malawi (2%) and Tanzania (1%). Other countries on the list each have a share of less than 1% in world pigeon pea area (Table 9).

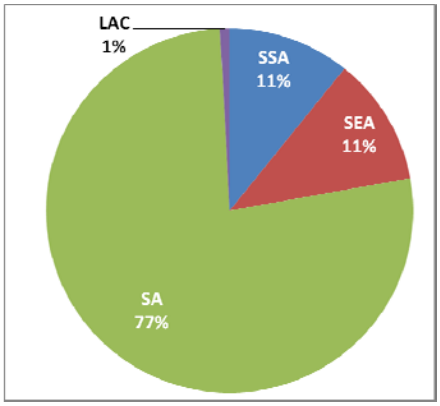
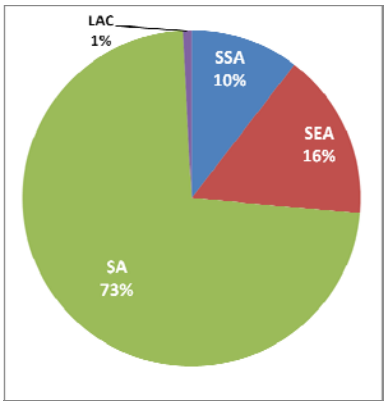


Figure 20. Regional shares in total pigeon pea area harvested and total production in 2006-08



Pigeon pea **AREA** harvested = 4.7 m ha

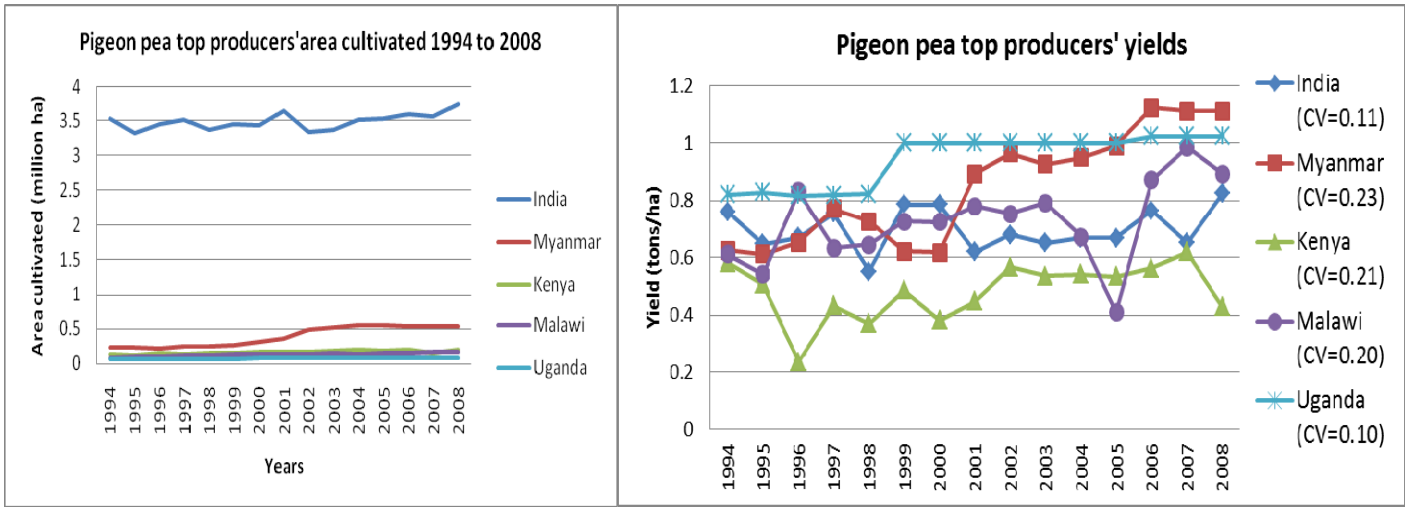
Pigeon pea **PRODUCTION** = 3.75 m tons

Area harvested for pigeon pea has stayed relatively stable in the top five pigeon pea growing countries in the last 14 years (Figure 21). Pigeon pea yield in these five countries has seen diverging trends in the same time period with Myanmar and Uganda both on the top with more than one ton/ha in recent years. Myanmar has also experienced a steady and steep increased in pigeon pea yields from 1994-2008. For India, the largest pigeon pea producing country, the yields have fluctuated between 0.6 to 0.8 tons/ha (CV=0.11). Malawi has seen both a dramatic decline and a sharp increase in yields in the last five years, which is reflected in the high CV (0.20) (Figure 21).

Table 9. Top Pigeon Pea Producing Developing Countries Ranked by Area Harvested, 2006-08

	countries	Average Area harvested 2006-08 (million ha)	Percent share in area harvested 2006-08	Cumul. percent share 2006-08	Average Production 2006-08 (million tons)	Average Yield 2006-08 (tons/ha)
1	India	3.62	76.57	76.57	2.71	0.75
2	Myanmar	0.54	11.37	87.94	0.60	1.12
3	Kenya	0.18	3.85	91.79	0.10	0.53
4	Malawi	0.16	3.38	95.17	0.15	0.92
5	Uganda	0.09	1.84	97.01	0.09	1.02
6	United Rep of Tanzania	0.07	1.43	98.44	0.05	0.72
7	Dominican Republic	0.02	0.48	98.92	0.02	0.89
8	Nepal	0.02	0.44	99.37	0.02	0.91
9	Dem. Rep of the Congo	0.01	0.21	99.58	0.01	0.72
10	Haiti	0.01	0.13	99.70	0.00	0.40

Figure 21. Trends in area and yield in top pigeon pea growing countries, 1994-2008



3.5. Lentils area, production and yield trends

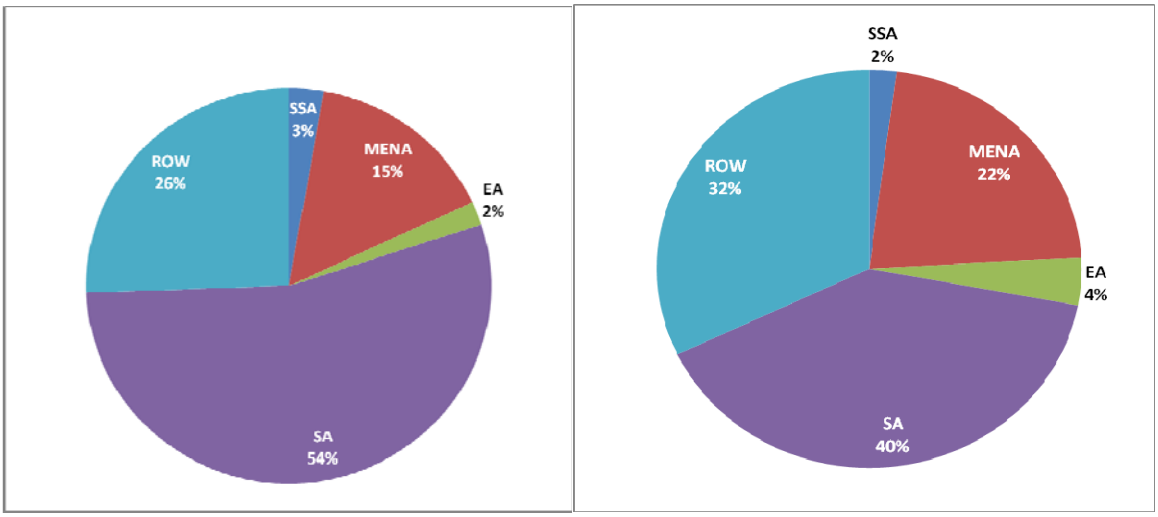
Lentils (*Lens culinaris)* are relatively tolerant to drought and are grown throughout the world. Worldwide, lentil area harvested has increased by 6% from 3.4 m ha in 1994-08 to 3.6 m ha in 2006-08 (Table A4.5). Production has increased four times more than area (by 22%) in the same time period as a result of a 15% increase in yields from 0.8 tons/ha in 1994-06 to almost one ton/ha in 2006-08 (Table A4.5). South Asia is the largest lentil growing and producing region in the world with a share of more than 50% in total area and 40% in total production (Figure 22). As a food pulse crop, lentil is both a developed as well as a developing country crop. The share of developed countries (mostly Canada, U.S. and Australia) is more than ¼ in total area and almost 1/3 in total production. The other major lentil growing and producing region is the Middle East and North Africa (MENA) with a share of 15% in total area and 22% in total production. Both East Asia and SSA are comparatively minor regional players (although some countries in this region are among the top 10 lentil producers in the world) (Figure 22).

Table 10 presents a list of major lentil growing countries in the developing world. Countries from the SA and West Asia region dominate the scene with India covering 40% of the world lentil area, followed by Turkey (9%), Iran and Nepal (5% each), Syria (4%), and Bangladesh and Ethiopia (3% each). All the

other developing countries grow lentils on less than 100,000 ha and mostly have a share of less than 1% in global lentil area (Table 10).

The trends in area and yield in top five lentil growing countries are given in Figure 23. The trend in area devoted to lentil has remained relatively stable over the past 14 years for Iran, Nepal and Syria. But it has seen a gradual increase in India and a gradual decrease in Turkey the top two lentil growers in the world. Yields on the other hand, show a declining trend in Iran and Syria. On average, the lentil yields in Syria and Turkey have been the highest and peaked at more than one tons/ha in 2000s. But they have also seen the biggest drops (more than 50%) in yields in some years. This is reflected in the relatively high CV for lentil yields for Turkey and Syria (Figure 23). A thing to be noted about lentils is that it is one of the lowest yielding food pulse crop in developed countries as well, with an average yield for ROW less than 1.2 tons/ha in 2006-08 (Table A4.5). The estimated yields of lentil crop in 2006-08 period in the top three developed countries was 1.35 tons/ha (Canada), 1.1 tons/ha (USA), and 0.6 tons/ha (Australia) (FAOSTAT).

Figure 22. Shares in world lentil area and production by regions, 2006-08



World AREA harvested = 3.6 m ha

World lentil PRODUCTION = 3.4 m tons

Figure 23. Trends in area and yield in top lentil growing countries, 1994-2008

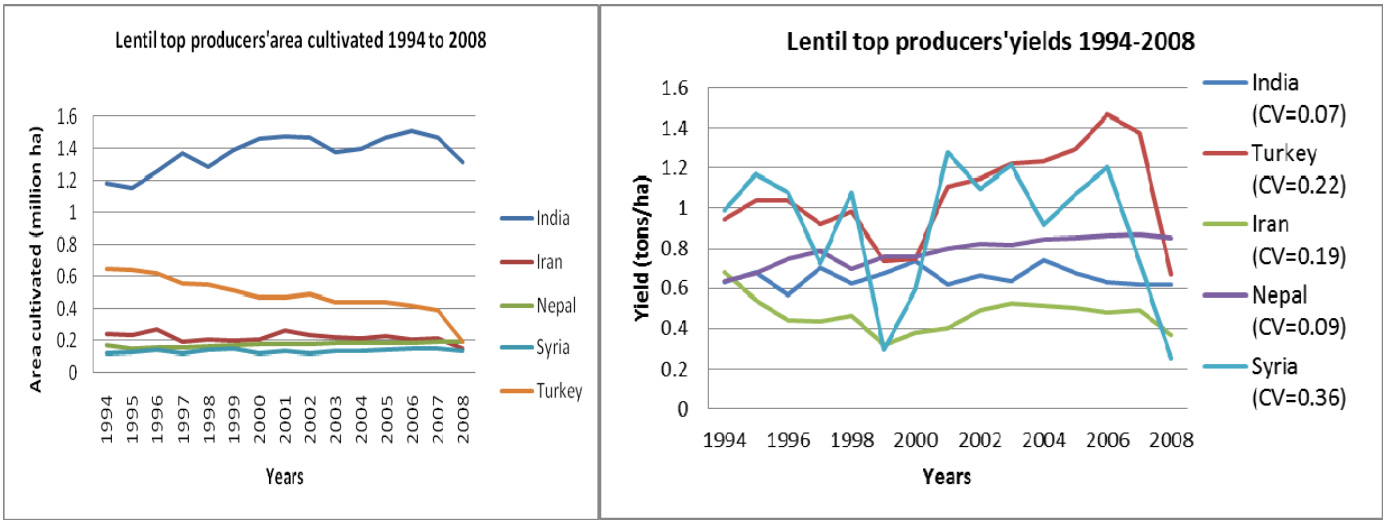


Table 10. Top Lentil Producing Developing Countries Ranked by Area Harvested, 2006-08 \a

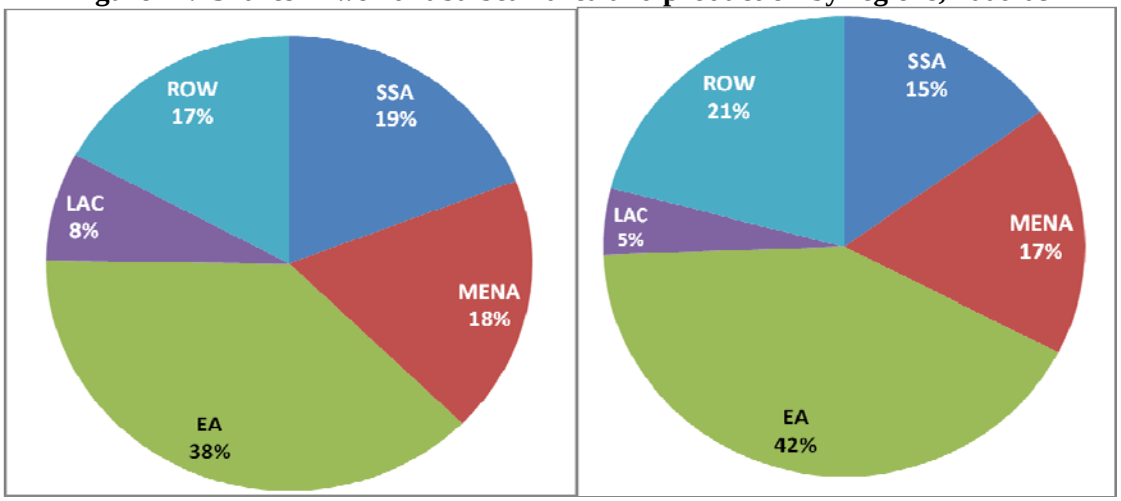
	Countries	Average Area harvested 2006-08 (million ha)	Percent share in area harvested 2006-08	Cumul. percent share 2006-08	Average Production 2006-08 (million tons)	Average Yield 2006-08 (tons/ha)
1	India	1.43	39.54	39.54	0.89	0.62
2	Turkey	0.34	9.31	48.85	0.43	1.28
3	Iran (Islamic Republic of)	0.19	5.28	54.13	0.09	0.46
4	Nepal	0.19	5.18	59.31	0.16	0.86
5	Syrian Arab Republic	0.14	4.01	63.32	0.11	0.74
6	Bangladesh	0.11	3.18	66.49	0.10	0.88
7	Ethiopia	0.10	2.67	69.16	0.08	0.80
8	China	0.07	1.86	71.02	0.14	2.03
9	Morocco	0.04	1.09	72.11	0.02	0.44
10	Pakistan	0.03	0.95	73.06	0.02	0.52
11	Yemen	0.01	0.31	73.37	0.01	0.79
12	Mexico	0.01	0.21	73.58	0.01	1.06
13	Iraq	0.01	0.17	73.75	0.01	1.24
14	Colombia	0.00	0.11	73.86	0.00	0.28
15	Peru	0.00	0.10	73.96	0.00	0.88

\a Does not include developed countries, some of whom are major lentil growing countries with area close to 0.6 million ha (Canada), 0.14 m ha (USA) and 0.13 m ha (Australia).

3.6. Faba bean area, production and yield trends

Faba beans *(Vicia faba)*, also known as the Broad Bean, Fava Bean, Field Bean, Bell Bean or Tic Bean is a 'bean' species native to North Africa and West Asia. It is a hardy crop and can withstand rough climates, especially cold ones. World faba bean area harvested in 2006-08 stands at 2.5 m ha, up by 5% from 1994-96 (Table A4.6). Today, China is the largest producer of Faba beans which gives East Asia the largest share in world total area harvested (38%) and total production (42%) (Figure 24). The next largest faba bean growing regions are SSA and MENA, each covering 19% and 18% of world area, respectively. But in terms of volume of production, ROW (i.e., developed countries) ranks second with 21% share in total world production of faba beans. Faba beans are also grown in Latin America which has a share of 8% of total area harvested and 5% of total production in 2006-08 (Figure 24).

Figure 24. Shares in world faba bean area and production by regions, 2006-08



World faba bean **AREA** harvested = 2.5 m ha

World faba bean **PRODUCTION** = 4.1 m tons

Over the past 14 years, the faba bean area harvested in East Asia and Middle East and North Africa has declined by 12% and 1.5% respectively, while it has increased by 38% is Sub-Saharan African. Average faba bean yields are the highest among all the focused food legume crops in this study. Average yields in 2006-08 period for the world was estimated to be 1.7 t/ha ranging from one ton in LAC to 1.9 tons in EA regions and averaging 2.1 tons in ROW. During the last 14 years, yield has improved in all the top three developing regions; about 39% in SSA, 13% in MENA and 6% in EA. The LAC region has witnessed the most significant increase in yields (40%) over the past 14 years (Table A4.6).

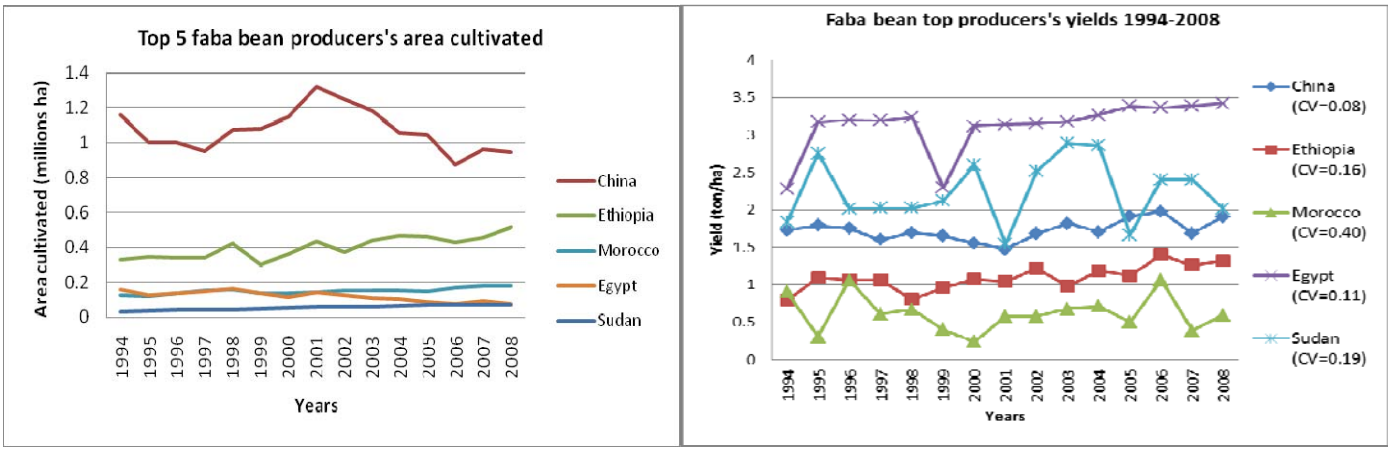
As noted before, China is the leading country not only in East Asia but in the world with a share of 38% of area harvested (Table 11). It reached a peak in area harvested of 1.3 m ha in early 2000s before it decreased to 0.9 million ha in recent years. Ethiopia, Morocco, Egypt and Sudan have observed more or less stable trends in area cultivated from 1994 to 2008 (Figure 25). Yields of faba beans have seen more fluctuations than area harvested in all the top five countries (Figure 24). The CV of yields from 1994 to 2008 in top faba bean producing countries range from 0.08 in China to as high as 0.4 in Morocco. Egypt has maintained high yields (more than 3 t/ha) throughout the last 14 years, followed by Sudan (2-2.5 t/ha), China (1.5-2 t/ha), Ethiopia (1-1.5 t/ha) and Morocco (0.5-1 t/ha). Unlike other legume crops studies, there is a big yield gap, in the range of 3 tons/ha among the top faba bean growing countries in the developing world.

Table 11. Top Faba Bean Producing Developing Countries Ranked by Area Harvested, 2006-08 \a

	countries	Average Area harvested 2006-08 (million ha)	Percent share in area harvested 2006-08	Cumulative percent share 2006-08	Average Production 2006-08 (million tons)	Average Yield 2006-08 (tons/ha)
1	China	0.93	37.65	37.65	1.72	1.85
2	Ethiopia	0.47	19.03	56.68	0.62	1.33
3	Morocco	0.18	7.20	63.88	0.12	0.68
4	Egypt	0.08	3.17	67.05	0.26	3.39
5	Sudan	0.07	2.76	69.81	0.15	2.27
6	Tunisia	0.05	2.18	71.99	0.06	1.03
7	Peru	0.05	2.01	74.00	0.06	1.23
8	Brazil	0.04	1.54	75.54	0.02	0.45
9	Algeria	0.03	1.29	76.83	0.03	0.79
10	Guatemala	0.02	0.98	77.81	0.01	0.52
11	Mexico	0.02	0.84	78.65	0.03	1.21
12	Syrian Arab Republic	0.02	0.69	79.34	0.03	1.82
13	Paraguay	0.01	0.57	79.91	0.01	0.86
14	Ecuador	0.01	0.54	80.45	0.00	0.30
15	Bolivia	0.01	0.54	80.98	0.01	1.03
16	Turkey	0.01	0.43	81.41	0.02	1.99
17	Dominican Republic	0.01	0.34	81.75	0.01	1.32
18	Nepal	0.01	0.32	82.07	0.01	0.72
19	Israel	0.01	0.20	82.28	0.03	5.02
20	Iraq	0.00	0.16	82.44	0.01	2.65

\a Does not include developed countries, some of whom are major faba bean growing countries, such as Australia with more than 100K ha, France (60K ha) and UK (about 50K ha).

Figure 25. Trends in area and yield in top faba bean growing countries, 1994-2008



3.7. Trends in area, production and yield for soybean in West Africa

The soybean (also called, soya bean) (*Glysine max*) is a legume crop native to East Asia. Soybeans can produce at least twice as much protein per acre as any other major vegetable or grain crop, 5 to 10 times more protein per acre than land set aside for grazing animals to make milk, and up to 15 times more protein per acre than land set aside for meat production.[14] As noted before, this plant is usually classified as an oilseed rather than a pulse. But in Africa, where soybean is a new crop (first introduced in late 1800s),[15] extensive work has been done to incorporate soy as a food legume in people's diets, either directly in the seed form or processed into value-added foods (e.g., soynuts, soymilk, soy pulp) or added as a fortifier in traditional foods. In this study, the trend analysis of soybean only focuses on West Africa region where IITA has done extensive work in soybean improvement research and is promoting it as a food legume.

Nigeria is the largest soybean producing country in SSA. In 2006-08 a total of about 661 thousand ha of soybean were harvested in West Africa, 95% of which was grown in Nigeria and the rest 5% in other West African countries as noted in Table 12. Over the past 14 years, soybean area in West Africa has increased by 14% (from 582 to 661 thousand ha), production has increased by 126% (from 272 to 616 thousand tons), and yields have doubled from 0.47 tons/ha in mid 1990s to 0.93 tons/ha in 2006-08 (Table 12). However, despite the high yield growth rate, soybean yields in WA are lower than in other parts of SSA (Table 12). Compared with WA, total area under soybean in the rest of SSA (which includes Eastern, Central and Southern Africa) increased by 46% from 271 thousand ha in 1994-96 to 396 thousand ha in 2006-08 and production increased by 52% from 313 thousand tons to 476 thousand tons over the same time period. However, soybean yields in other parts of SSA increased only marginally from 1.16 t/ha in mid-1990s to 1.2 t/ha in late 2000s (Table 12).

Although, Liberia, Burkina Faso and Mali have experienced rapid increase in soybean area and production, the area harvested in 2006-08 is still less than 8,000 ha, which is insignificant compared to the 625,000 ha of soybean in Nigeria. With more than 18K ha, Benin is a distant second important soybean producing country in the region and it has seen a dramatic increase in soybean production, mainly from 850% increase in area cultivated (Table 12).

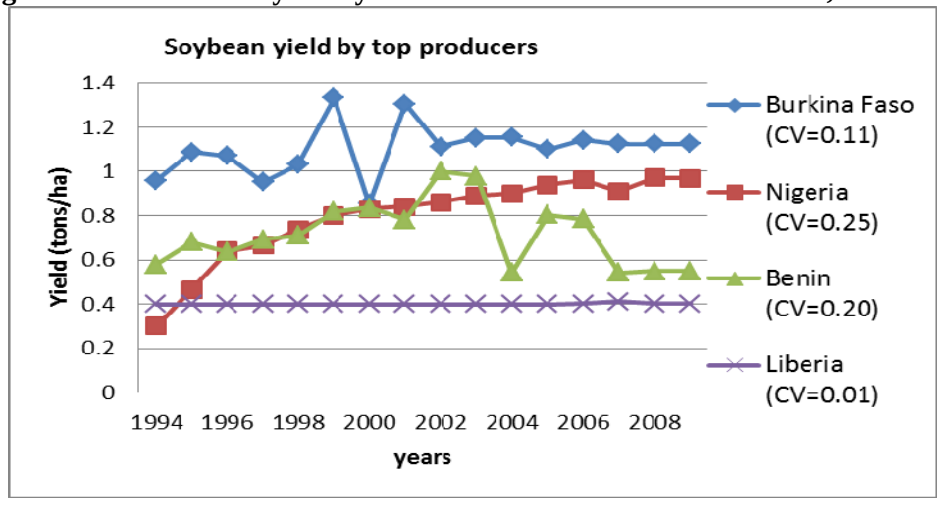
[14] "Soy Benefits". National Soybean Research Laboratory. http://www.nsrl.uiuc.edu/soy_benefits.html. Retrieved 2011-02-09.
[15] See Shurtleff and Aoyagi (2007).

The country that dominates the story of soybean in West Africa (and for SSA) is Nigeria, which has seen its soybean production in the last 14 years more than double from 260K tons to almost 600K tons. This has been made possible mainly due to a 100% increase in yields, which is also reflected in the regional statistics. The trend of soybean yield from 1994 to 2008 is mixed—with Nigeria showing a steady increase, Liberia remaining almost stable, and Burkina Faso and Benin showing lots of ups and downs around a declining trend line as evident from a relatively high CV for the time period 1994-2008 (Figure 26).

Table 12: Area, Production and Yield of Soybean in West Africa and Rest of SSA, 1994-06 and 2006-08

	Nigeria	Benin	Liberia	Burkina Faso	Côte d'Ivoire	Mali	West Africa	Rest of SSA
Area Harvested (Thousand ha)								
1994-1996	570.67	1.98	5.00		2.65	1.07	582.51	271.00
2006-2008	625.67	18.82	7.87	5.1	0.68	3.17	661.39	395.57
Change in area	55.00	16.84	2.87	4.04		2.11	78.88	124.60
% Change	10%	849%	57%	355%	-74%	198%	14%	46%
Growth rate (%/year)	1%	21%	4%	13%	-11%	10%	1%	3%
Production (Thousand tons)								
1994-96	262.33	1.2	2.00	1.85	3.07	1.77	272.25	313.11
2006-08	592.00		3.18	5.85	0.69	3.73	616.16	475.62
1Change in production	329.67	9.47		4.01	(2.38)	1.96	343.91	162.51
Change	126%	766%	59%	217%	-78%	111%	126%	52%
Growth rate (%/year)	7%	20%	4%	10%	-12%	6%	7%	4%
Yield (tons/ha)								
1994-96	0.46	0.62	0.40	1.62	1.16	1.66	0.47	1.16
2006-08	0.95	0.57	0.40	1.13	1.00	1.18	0.93	1.20
Change in yield	0.49	-0.05	0.00	-0.49	-0.15	-0.48	0.46	0.05
% Change	105.83%	-8.78%	1.17%	-30.37%	-13.23%	-29.03%	99.33%	4%
Growth rate (%/year)	6.2%	-0.8%	0.1%	-3.0%	-1.2%	-2.8%	5.9%	0.3%

Figure 26. Trends in soybean yields in some West African countries, 1994-2008

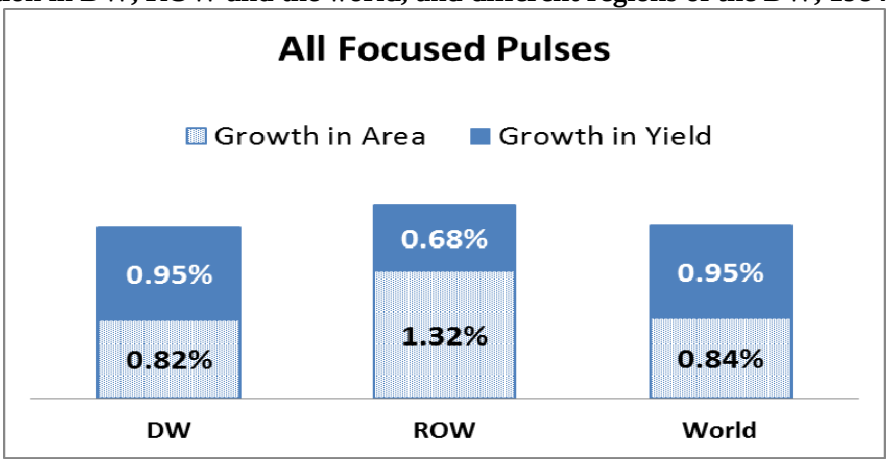


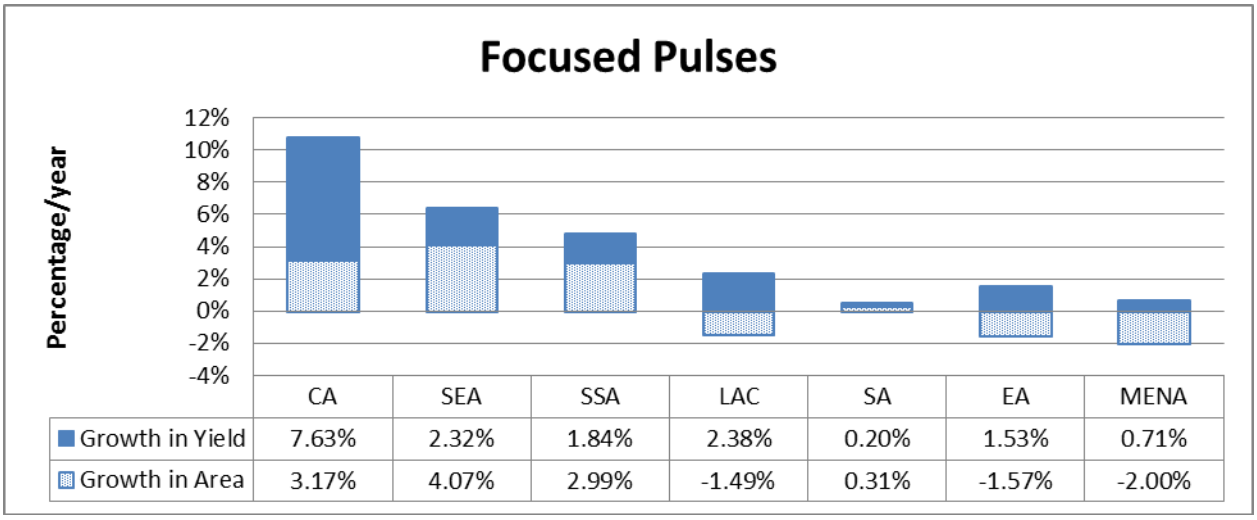
3.7 Summary

Figures 27 and 28 capture the global picture on regional trends in area, production and yield of major pulse crops discussed so far. There are many bright spots and some not so bright spots in this picture worth highlighting. First, over the past 14 years, the overall growth rate in the production of major pulses

in the world focused in this study (1.8%) has been more than the growth rate in population (1.3%). In fact, this is also true for the developing world as a whole. Despite the unfavorable production systems and marginal environments in which pulses are grown relative to major cereal crops, this trend is noteworthy. Most of the contribution to this positive growth in production has come from increased yields in developing countries, which is another positive story for pulse crops (Figure 27). In developed countries, two-thirds of the growth in production has come from area expansion, especially in countries like Canada where land resources are relatively abundant and the country has responded in recent years to increased demand for pulse grain from pulse deficit countries such as India.

Figure 27: Contribution of area and yield growth rate in growth rate of pulse production in DW, ROW and the world, and different regions of the DW, 1984 to 2008





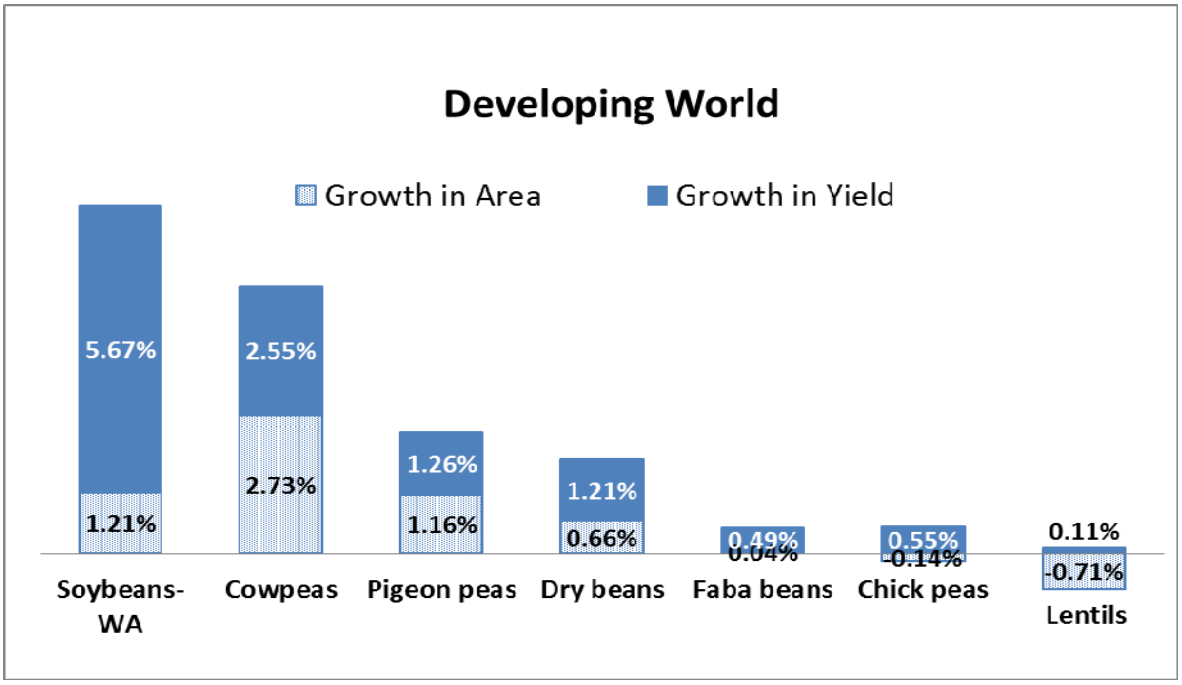
	CA	SEA	SSA	LAC	SA	EA	MENA
Growth in Yield	7.63%	2.32%	1.84%	2.38%	0.20%	1.53%	0.71%
Growth in Area	3.17%	4.07%	2.99%	-1.49%	0.31%	-1.57%	-2.00%

In developing regions, the major contributor to the 1.8%/year overall growth rate in pulse production has been SSA (Figure 27). This is the third bright spot of the global picture. With an average growth in yield of 1.8% and in area of 3%, SSA has contributed more than 50% to the increased production of pulses over the last 14 years. In terms of pulse production growth, SSA has performed better than LAC and SA, the two largest pulse producing regions of the world. A major contributor to this positive story for SSA is the

high growth rate in the production of cowpeas, which is mostly grown in that region.[16] In terms of production growth rate among major pulse crops, cowpeas and soybean in WA have shown the biggest increase, which are followed by pigeon peas and dry beans (Figure 28). For all these crops, the production over the past 14 years has increased at a rate faster than the population growth rate in the developing world. For dry bean, soybean in WA and pigeon peas, the majority contributor to this growth in production has been yields, which is another positive aspect of the pulse story in developing countries.

The overall picture for faba beans, chickpeas and lentils over the last 14 years has not been so favorable (Figure 28). Faba beans and chickpeas have exhibited a small positive growth rate, and lentil has experienced an overall negative growth rate in production mostly due to declining area. These crops are major crops produced and consumed in MENA and SA region, which explains the less than average performance of these regions compared to other regions of the DW (Figure 27).

Figure 28: Contribution of area and yield growth rates to growth rates of production of focused pulse crops in developing countries, 1984 to 2008



Despite the many positive stories, the average yields of pulses in DW still remain less than one ton/ha, which is one-fourth the average yields of cereal crops in DW. Also, despite the positive story for SSA, that region still remains at the bottom of the list of regions ranked in terms of average pulse yields. Similarly, cowpea remains one of the lowest yielding pulse crops (with less than 0.5 t/ha average yields). Increasing the average yield of all pulse crops thus remain a major challenge to increase the competitiveness of the pulse sector in developing countries.

The overall positive growth rates for the developing world and pulses as a group masks some of the challenges faced at the country level. In some important pulse producing and consuming countries, the production growth rate has not kept pace with the growth in demand for pulses, mostly fueled by the growth in population. This has led to increasing imports of pulse crops by some of the large pulse consuming countries such as India, Brazil and Turkey. In general, culture-specific preferences for type,

[16] Again, we point to the missing data for cowpea for Brazil and India, and thus their exclusion from the coverage in the FAO dataset on which this analysis is based.

color and size are very strong for pulse crops (for e.g., preference for desi chickpea, black gram and green gram in India; black beans and colored beans in Brazil; small red beans in Central America; red lentils in Turkey, etc.) leading to a strong demand for locally produced pulse grains. But when local production is not able to meet the demand for consumption for specific types of pulses, countries have to often look for surplus production elsewhere, which may be limited for a preferred type of pulse grain. This creates instability in domestic markets and increases the domestic prices for those pulses. Thus the challenges faced by many countries to increase pulse production are inter-linked with the trends and patterns in price, trade and consumption of pulses domestically and around the world. These themes are explored in the following sections.

4. Trends in Global and Regional Average Producer Price of Major Food Legume Crops

Data on producer price for all the countries and all the years is unfortunately not available. FAO (PriceSTAT) reports time series producer price data converted into US$ for many countries and commodities. We present the available producer price data for major producing countries by commodities for the period 1994-2008 in Annex 5. The analysis presented here for the pulse crops only includes top producers for a given commodity and represents a simple average across countries (i.e., it is not weighted by production). Due to missing data for many important countries, it should be noted that the average prices reported here are not strictly representative of the group of top producers of a given commodity. Also, the price data presented is in nominal US$ (not adjusted for inflation rate).

In general, the producer price of food legume crops across top pulse producing countries is significantly higher than producer price for cereal crops (i.e., wheat, rice, maize, millet, sorghum and barley) for the same set of countries (Figure 29). This observation is not only true in developing countries but also the developed world as evident by the level and trend over the last 14 years in the average producer price for cereal crops and major pulse crops.[17] In the last three years (2006-08), producer price for pulse grains was, on average double the average price for cereal crops in the top pulse producing developing countries ($332/ton for cereal crops vs. $703/ton for pulses) and more than three times higher in developed countries ($234/ton for cereal crops vs. $783/ton for pulse crops) (Figure 29). In the past 14 years, the average nominal producer price of pulse crops in top pulse producing developing countries has increased by more than $200/ton, representing a growth rate of 1.5%/year. For the same time period, the average producer price in developed countries (ROW) has more than doubled (from $400 to $800), representing a 3%/year growth rate. For both the crops and regions, the producer price has been on a steeper upward trend in the decade of 2000 compared to the declining or stagnant trend observed in the 1990s. This is perhaps a combination of the weakening dollar and high inflationary pressure resulting in the increasing cost of inputs observed in the last few years.

Figure 30 shows the comparative trends in average producer price of major pulse crops in the respective top producing developing countries (DW). As can be seen, there is a large variability between producer price of different pulse crops, with soybean in West Africa at the lower end and dry bean, lentils and chickpea at the higher end of the price spectrum. The difference in price level between these two extreme points is almost double. The producer price of soybean in West Africa is significantly lower than even the average producer price for pulse crops depicted in Figure 29.

In recent years, the average producer price (in nominal $) for many pulse crops in several top producing countries has surpassed $1000/ton (see country specific price data in Annex 5). For example, the following countries have seen the producer price for one ton of pulse grain reach more than $1000 mark

[17] For coverage of developing countries and country-specific producer prices by crops, see Annex 5. The top pulse producing developed countries included in this analysis are: Australia, Canada, Greece, Italy, Portugal, Russian Federation, Spain and the United States of America.

in 2006-08: Brazil, Argentina and Congo for dry beans; Israel for faba beans; Turkey, Tunisia, Sudan for Chickpea; Nepal for pigeon pea; and Iran, Turkey, Morocco for lentils.

Figure 29. Average Producer Prices (in nominal US$) of Food Crops in Developing Countries (DW) and Developed Countries (ROW): A Comparison between Cereal Crops and Legumes Focused in this Study in Top Legume Producing Countries

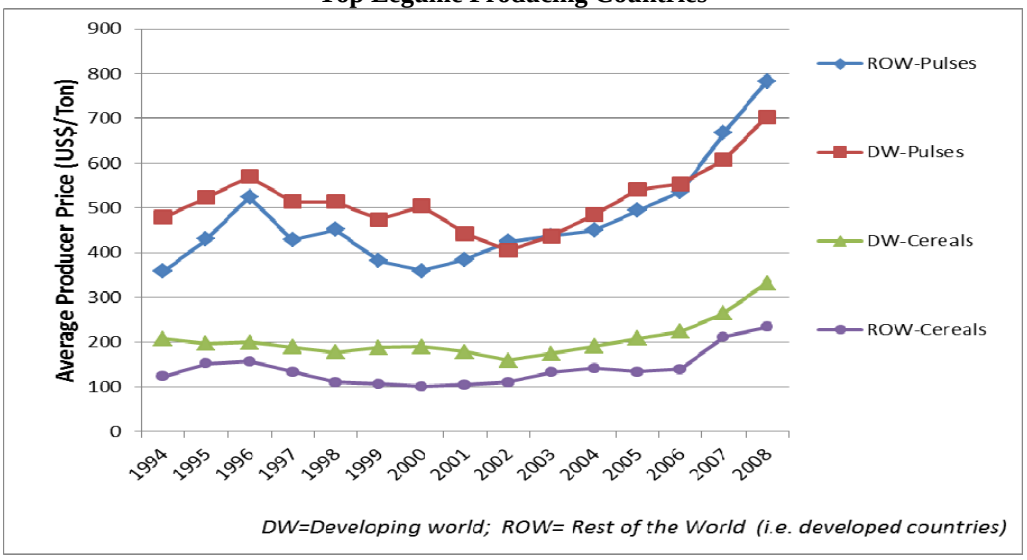
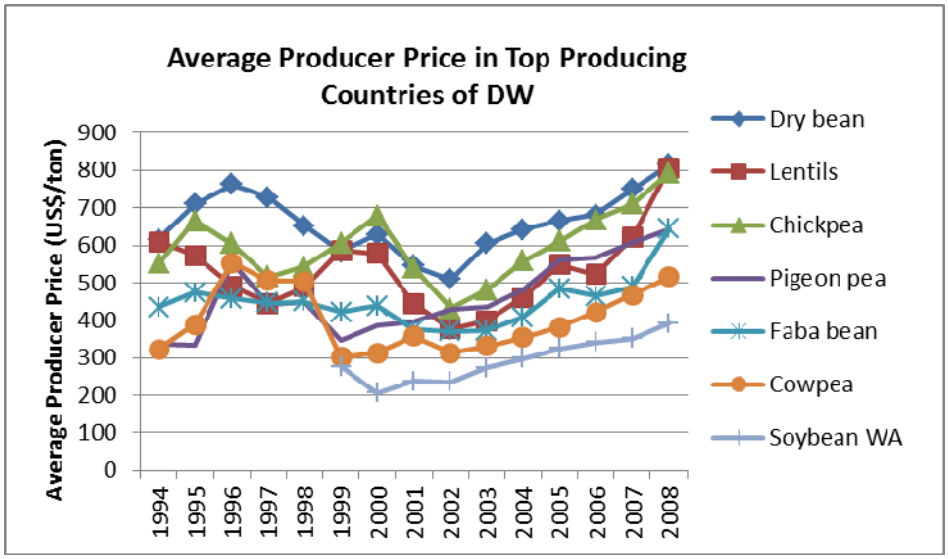


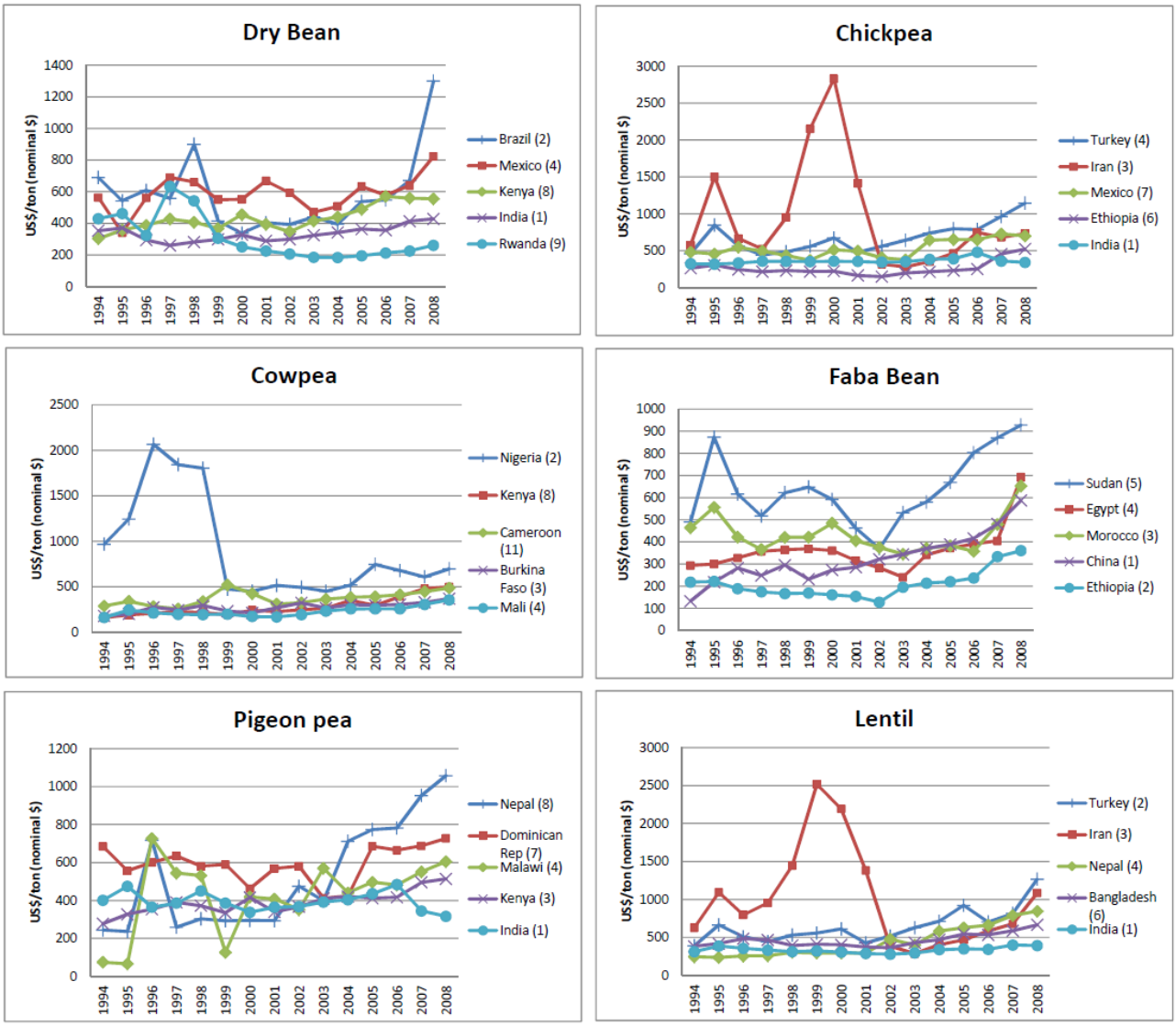
Figure 30. Average Producer Price of Major Pulse Crops in Top Producing Countries in the Developing World, 1994-2008



For a given crop, there is also a great deal of variability in producer prices at the country level, which makes it difficult to discuss about trends with any confidence. Tables A5.1 to A5.6 in Annex 5 provides producer price from 1994 to 2008 of the six focused pulse crops (dry beans, chickpea, cowpea, lentil, pigeon pea and faba bean) in top producing developing countries identified in Section 3.1 (ranked by area harvested). Figure 31 presents this data in a graphical format for the five top countries for which price data are available. For dry beans, the average producer price for the top 20 dry bean growers has increased by 30% since 2000, from $629/ton in 2000 to $815/ton in 2008 (Table A5.1), reversing the declining trend from 1994 to1999. Since 2000, the top producer, India, has seen an increase in producer

price by about 31%, which is at the lower end compared with price increase observed by other top producers like Brazil (286% increase) and Mexico (49% increase) over the same time period (Figure 31). The difference in producer price trend in India and the other two LAC countries could partly be due to the different types of dry beans included in the analysis. For India, the data represents mostly mung beans, black gram, and moth beans, and for Brazil and Mexico the data represents mostly common beans. The only country that has documented a decline in producer price or a steady price trend for dry beans is Korea (-36% change over the last 8 years) and Nicaragua (-15% change over the last 8 years).

Figure 31: Trends in Producer Price of Major Pulse Crops in Five Top Producing Countries in the Developing World, 1994-2008 (in nominal US$) \a



Source: FAO PriceSTAT

\a Number in the parenthesis next to the country indicates the country's rank as measured by area harvested in 2006-08

The average producer price of chick pea for the top 20 growers in the Developing World has increased by 17% since 2000, which is one of the lowest percentage increases in price among all the focused pulse crops (Table A5.2). In India (the largest grower), the producer price has remained stagnant over the last

14 years or declined in nominal value by 5% since 2000. This is quite a contrast with the increased price trend observed in Turkey and Ethiopia over the same time period (two of the top 6 growers of chickpeas in DW) (Figure 31). The price data for Iran for both chickpea and lentils show a steep increase in the late 1990s-early 2000s, which may be an indication of either a problem with the data for Iran or it may represent sharp fluctuation/adjustment in exchange rate of the Iranian currency around that time frame.

The average producer price of cowpea for the top 20 growers in Developing World has increased by 60% over the last 14 years and 65% over the last 8 years (Table A5.3). This represents one of the highest percentage increases in producer price among all the pulse crops. Nigeria, the second biggest grower has observed a 34% increase in producer price since 2000; but over the last 14 years the nominal price has declined by almost 25%. This is due to the significantly high producer price recorded for that country in the mid-1990s (Figure 31). Other large producers in West Africa--Burkina Faso and Mali have seen the producer price in nominal US$ more than double since 1994 (Table A5.3). Unfortunately, price data for the largest cowpea grower—Niger and other top growers in West Africa and elsewhere (e.g., Myanmar and Tanzania) are not available to do a comparative analysis.

The average producer price for the top ten pigeon pea growers in the world (a crop which is predominantly grown in the Developing World) over the last 14 years is presented in Table A5.4 and for the five top producers in Figure 31. Pigeon peas have observed one of the highest producer prices in recent years and the average price in top producing countries has increased by 92% over the last 14 years and 67% over the last eight years. Contrary to the trend, but similar to chickpea, the producer price for pigeon pea in India, which is the top producing country, has dropped by 21% since 1994. In the last eight years, the producer price in all other countries where data are available has increased in the range of 24% (Kenya) to 258% (Nepal) (Table A5.4). Again, pigeon pea producer price data for Myanmar and some important East African countries are not available.

Except for the data anomaly for Iran, the average producer price for lentils in the five top lentil growing countries has steadily increased over the past 14 years (Figure 31). Since 2000, India, Turkey, and Nepal (among top 5 producers) have seen price increases of 29%, 108% and 186% respectively (Table A5.5). All the countries for which data are available show an increase in producer price for lentils. Average producer price of Faba bean in Developing World has increased by almost 50% from $435/ton in 1994 to $644/ton in 2008 (Table A5.6). Producer price in all top 5 producing has increased significantly over the past eight years; with 115% in China, 124% in Ethiopia, 35% in Morocco, 92% in Egypt and 57% in Sudan. The latter country (Sudan), which is the top five faba bean producers in the DW has seen the most dramatic and consistent increase in producer since 2002 (150% increase) (Figure 31).

In summary, the pulse market in the last 14 years is characterized by significant oscillations in farm-gate prices mostly due to supply and demand mis-match. The fluctuations in prices are also weather related. The variability is too high to provide clear trends with any confidence. But one thing is clear that the increased competition of land for other crops (such as bioenergy and oil crops) and the rising cost of production (fueled by increasing oil price) in recent years is adding an upward pressure on producer prices for most pulses. According to some analysts, the upward trend in pulse prices is projected to continue in the near future as domestic production in large pulse consuming countries is expected to continue to lag the demand for pulses (Clansey 2009, Rao et al. 2010). Because of strong demand, in the short-term, pulse markets may tend to react more strongly to harvest problems (related to weather conditions) than signs of over-production. However, in medium to long- term, as competition for land use begin to ease and large pulse producing countries like India, Brazil, Mexico and Turkey try to boost domestic production, pulse prices may come down and be influenced more by depth of demand rather than constraints on the supply side.

5. Trend Analysis of Global and Regional Trade of Major Food Pulse Crops

In 2006-08, about 6.7 million tons of pulse crops (focused by this study + 'pulses, nes') were traded representing a value of U.S. $4.3-$4.5 billion (Table 13). Global trade of pulse crops represents about 15% of global production. In other words, on an average about 85% of pulse crops consumed by people around the world is produced within the country and 15% is either imported or exported. The total volume of imports and exports globally has increased by 50% over the last 14 years from 4.4 to 6.7 million tons (Table 13). On the other hand, the value of imports and exports has more than doubled over the same time period representing a 6% annual growth rate (Table 13). This means the price of pulse crops traded in the world is increasing at a much higher rate than the quantity. This rising trend is consistent with the trend in producer prices discussed in section 4.

Table 13. Change in Global Volume and Value of Imports and Exports of Pulse Crops, 1994-96 to 2006-08

Import Quantity ('000 ton)

Item	1994-96	2006-08	Change	% change	Growth rate
Beans, dry	1,897.52	3,015.41	1,117.89	59%	3.9%
Faba bean	542.44	649.95	107.51	20%	1.5%
Chick peas	450.05	880.11	430.07	96%	5.7%
Cow peas, dry	1.26	2.93	1.67	132%	7.3%
Lentils	731.82	1,382.92	651.10	89%	5.4%
Pigeon peas	2.17	1.76	(0.41)	-19%	-1.7%
Pulses, nes\a	766.51	789.48	22.97	3%	0.2%
Total (All above pulses)	**4,391.76**	**6,722.56**	**2,330.80**	**53%**	**3.6%**

Import Value (million $)

Item	1994-96	2006-08	Change	% change	Growth rate
Beans, dry	1,127.06	2,260.19	1,133.13	101%	6.0%
Faba bean	150.02	259.84	109.83	73%	4.7%
Chick peas	266.68	636.48	369.80	139%	7.5%
Cow peas, dry	0.90	1.06	0.16	18%	1.4%
Lentils	350.82	915.33	564.51	161%	8.3%
Pigeon peas	1.75	1.57	(0.18)	-10%	-0.9%
Pulses, nes\a	346.99	441.67	94.68	27%	2.0%
Total (All above pulses)	**2,244.22**	**4,516.15**	**2,271.93**	**101%**	**6.0%**

Export Quantity ('000 ton)

Item	1994-96	2006-08	Change	% change	Growth rate
Beans, dry	2,386.31	3,491.61	1,105.30	46%	3.2%
Faba bean	525.15	592.57	67.42	13%	1.0%
Chick peas	451.86	906.52	454.66	101%	6.0%
Cow peas, dry	3.17	1.02	(2.15)	-68%	-9.0%
Lentils	774.06	1,507.59	733.53	95%	5.7%
Pigeon peas	12.90	3.51	(9.39)	-73%	-10.3%
Pulses, nes\a	256.20	249.96	(6.24)	-2%	-0.2%
Total (All above pulses)	**4,409.65**	**6,752.77**	**2,343.13**	**53%**	**3.6%**

Export Value (million $)

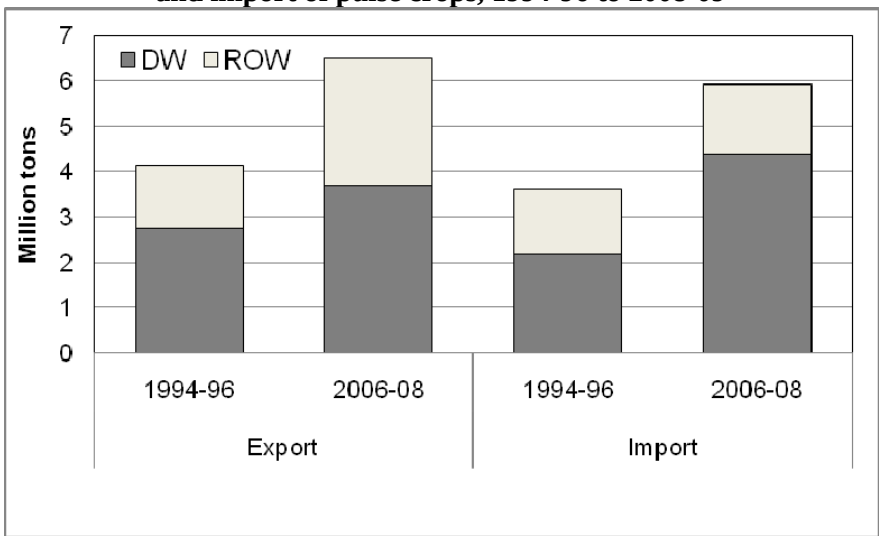
Item	1994-96	2006-08	Change	% change	Growth rate
Beans, dry	1,198.47	2,382.64	1,184.17	99%	5.9%
Faba bean	132.59	229.83	97.24	73%	4.7%
Chick peas	254.09	603.74	349.65	138%	7.5%
Cow peas, dry	2.20	0.83	(1.37)	-62%	-7.8%
Lentils	313.85	908.94	595.10	190%	9.3%
Pigeon peas	4.35	2.38	(1.97)	-45%	-4.9%
Pulses, nes\a	99.29	127.21	27.91	28%	2.1%
Total (All above pulses)	**2,004.84**	**4,255.56**	**2,250.73**	**112%**	**6.5%**

\a The category, 'Pulses, nes' (or other pulses unidentified) is included to show its global importance relative to other identifiable pulse crops focused in this study.

The share of developing world and 'rest of the world' (ROW) in global import and export of pulse crops is shown in Figure 32. The developing world as a group represent close to 75% share of the world imports of major pulse crops in 2006-08, up from 60% in 1994-96. Its share in world exports over the same time period has decreased by 5%, from 65% in 1994-96 to 60% in 2006-08 (Figure 32). This shows the growing importance of developed countries (ROW) in the exports of pulse crops to DW in recent years. In other words, developing countries on aggregate are importing more pulses from the DW compared to quantities they export to them in 2006-08.

The 'net importing' status of the developing world in 2006-08 is evident in Figure 33, which gives the regional share of different regions of the DW in import and export and how it has changed from 1994-96 to 2006-08. Developing countries as a group were net exporters of pulse crops in 1994-96, but have become net importers in 2006-08. The volume of exports by DW has increased 33% during this time period from 2.7 to 3.7 million tons (Figure 33). The biggest contributor to this growth in exports in the DW is the SE Asia region which saw its exports of pulse crops increase by 90% in the last 14 years. The import of pulse crops by DW has more than doubled during the last 14 years from just over 2 million tons in 1996-98 to more than 4 million tons in 2006-08 (Figure 33). The biggest contributors towards the rapidly growing imports by the DW are the South Asia and the MENA regions; they each have seen their imports more than double (MENA region) and quadruple (SA) over the last 14 years.

Figure 32. Level and change in the share of DW and ROW in global export and import of pulse crops, 1994-96 to 2008-09



As a result of the differential rates of growth in imports and exports of pulse crops, in 2006-08 SA, MENA, LAC and SSA regions were net importers of pulse crops, and EA, SEA and CA were net exporters. Figure 34 provides the total quantity of all pulse crops imported and exported by each region grouped by their net trading status. The figure also indicates the relative size of import and export of pulse commodities across regions (including ROW), and the magnitude of 'net' difference between export and import within a region. Thus, SA is not only the biggest importer but also the biggest net importer and SEA is the biggest net exporter of pulse crops. Overall, the developed countries (ROW) are the largest exporter and the second largest importer of pulse crops in the world (Figure 34).

Figure 33. Regional share in developing world's total export and import of food pulses, 1994-96 and 2006-08

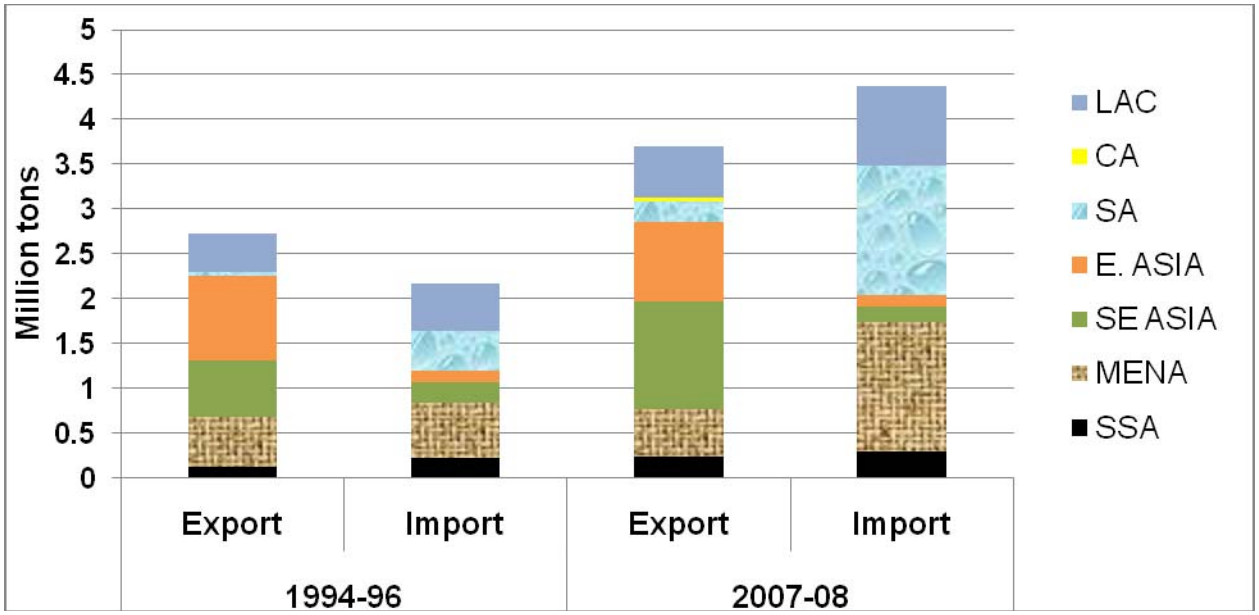
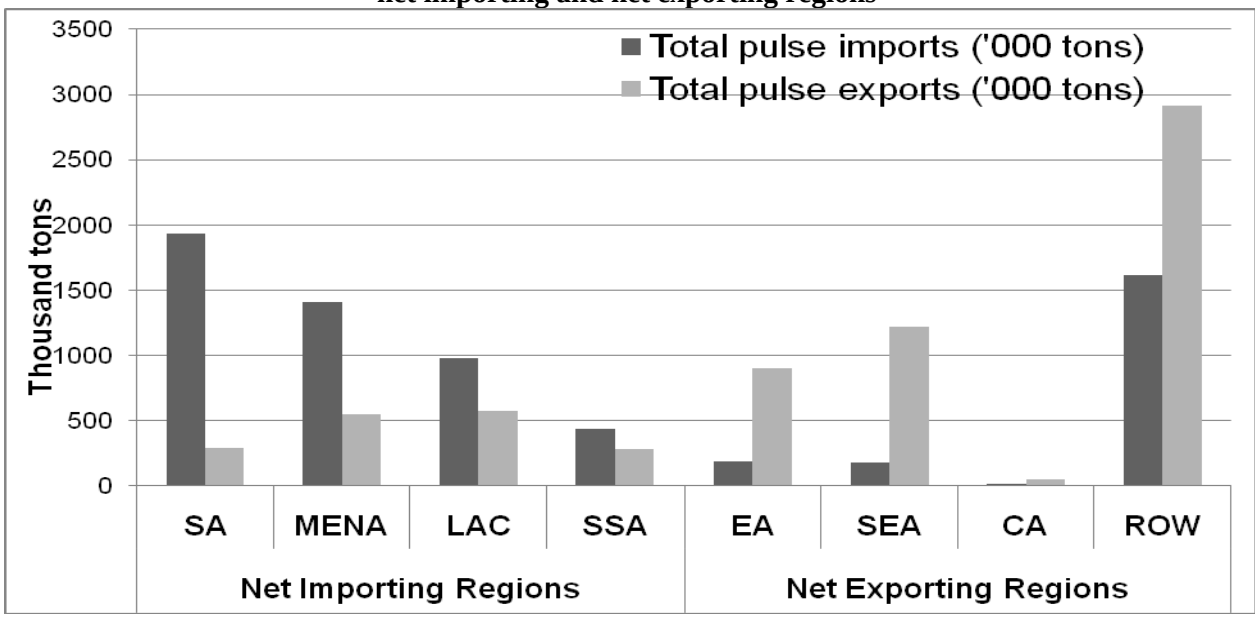


Figure 34. A comparative analysis of total pulse imports and exports in 2006-08 by net importing and net exporting regions



Dry beans are the most traded pulse crop in the developing world (and the world) (Table 35). In 2006-08, the DW region as a whole, exported 2.7 million tons of dry beans and imported only 2 million tons. Compared to dry beans, the DW region imported more of the other types of beans than they exported (Figure 35). Lentils, chickpeas and faba beans are the second, third and fourth biggest traded pulse crops in the DW. The category, 'pulses, nes' are also an important aggregate category of unidentified pulse commodities for which the DW seems to be a net importer. In 2006-08, DW as a region imported almost 0.75 million tons of unidentified pulse crops (i.e. pulses, nes), which is more than chickpea imports (Figure 35). On the world scene, cowpea and pigeon pea are not important traded commodities and are

thus not depicted in Figure 35. Also, because West Africa is an insignificant player in world soybean trade, we do not present any analysis of soybean trade status for WA.

Figure 35. Volume of exports and imports of major pulse crops in developing world (DW), 2006-08

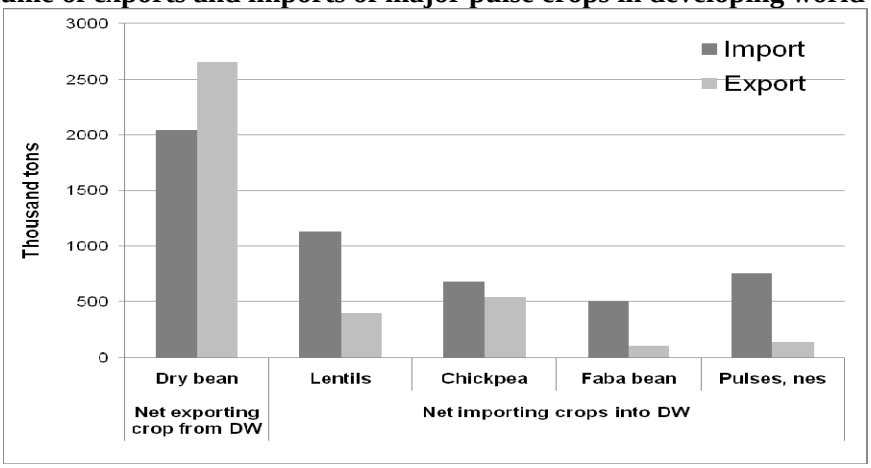
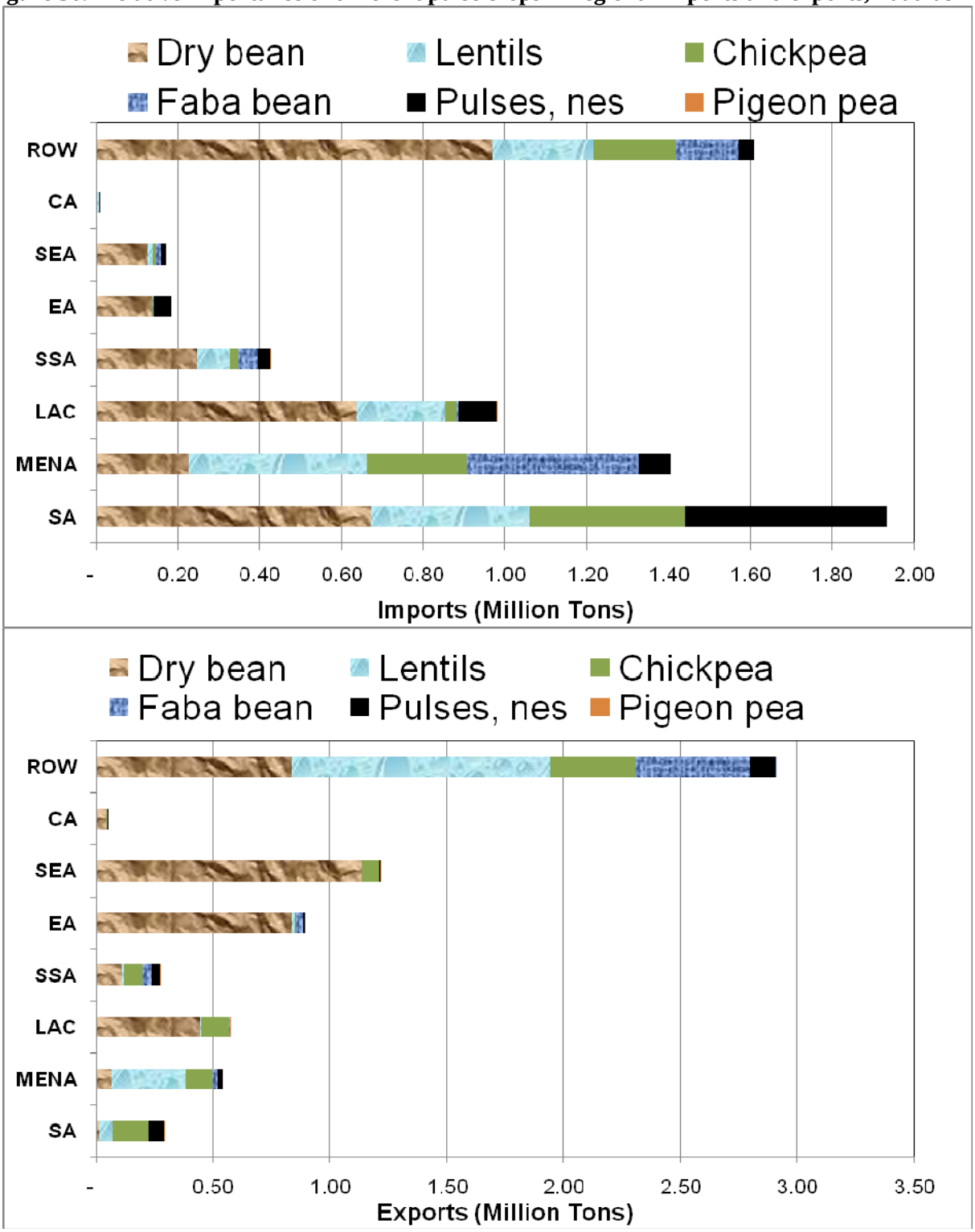


Figure 36 shows the size and relative importance of different pulse crops in regional imports and exports in 2006-08. Most regions are importers of multilple types of pulse crops, with MENA and SSA being the most diverse and importing all categories of pulse crops—dry beans, chickpea, lentils, faba bean and pulses, nes. South Asia imports dry beans the most, but is also a significant importer of chickpea, lentils and other unidentified pulses (pulses, nes) (Figure 36). In fact, in all regions (inlcuding ROW), dry beans have the largest share of total imports, except in MENA where where lentils have the largest share followied closely by chickpea.

The second panel in Figure 36 shows the relative size and share of different crops in regional exports of pulse crops. Not surprisingly, the biggest exporters of pulse crops are ROW (i.e., developed countries) and in DW they are SEA and EA regions. Both SEA and EA are major exporters of dry beans (which as a reminder, includes all types of phasealus beans and is not synonymous with common bean). Among developing world regions, SA is the largest chickpea exporting region (although as a region it is a net importer), and MENA is the largest lentil exporting region (although it is a net importing region for lentils) (Figure 36).

Annex 6 provides data on the volume and value of imports and exports of major pulse crops in 2008 by top countries ranked by value. For dry beans, India is the top importer (0.6 million tons) and China is the top exporter (0.95 million tons). The total value of dry bean imports by India in 2008 was $400 milliion, one of the highest among importers of any pulse crop. The other major importers of dry beans include Brazil, USA, Italy, U.K. and Japan, each with volume of imports more than 100K tons in 2008. Major exporters of dry beans after China inlcude Myanmar, USA, Argentina and Canada, with exports ranging from 200K-675K tons in 2008. Oddly, many countries appear on both the top list of importers as well as exporter of dry beans (e.g., USA, China, Mexico, etc.) (Annex 6). This is also the case with other pulse crops. One explanation for this is that FAO includes all types of *Phaseolus* beans in 'dry beans' category and it is possible that a major importing country for one type of *Phaseolus* beans may be a major exporter of another type. The other possible explanation could be the wide diversity in market classes for the same category of a pulse crop. For example, there are 5-6 major market classes of common beans—black, small red, light red kidney, dark red kidney, navy, great northern, etc.. In chickpeas, there are garbanzo types and the desi types. There are strong ethnic consumer preferences associated with different market classes of a pulse commodity type and it is possible that a country may be importing and exporting different types of market class of a given pulse crop.

Figure 36. Relative importance of different pulse crops in regional imports and exports, 2006-08



The top importers of faba bean are from the MENA and the mediterranean region--Egypt, Sudan, Italy, Saudi Arabia and UAE. The big exporting countries are from the developed region (France, Australia and UK) and other DW countries (China and Ethiopia). India is both the top importer and exporter of

Chickpea in the world. Other important importers include Pakistan, Spain, UAE, and Bangladesh. Major exporters are Australia, Mexico, Turkey, Myanmar and Canada. Canada is also the top exporter of lentils in the world, registering a value of $800 million of lentil exports, one of the highest among pulse crops. USA, Turkey, Australia, and surprisingly, UAE are listed as the other top lentil exporting countries in 2008. On the other side of the trade equation, Turkey, Sri Lanka, UAE, Egypt and Algeria are the major lentil importing countries (Annex 6).

In summary, over the past 14 years, developing countries on aggregate have increasingly met their growing pulse requirements through increased imports. The global trade in pulses in 2006-08 was 6.7 million tons with a total value of more than US$ 4.5 billion. The growth rate in the global import and export of pulses over the past 14 years has been more than the growth rate in production. A large portion of this growth has been due to larger imports by India, the world's largest producer and consumer of pulses. Another important international market for pulses that has emerged in recent decades is the MENA region, where imports are sustained by population growth.

Because trade in pulses grew more rapidly between 1994 and 2008 (3.6%/year) than output, the proportion of pulse production that gets traded has doubled from only 9% in the mid-1990s to 18% in 2006-2008.[18] Nevertheless, pulse trade remains a relatively thin market, especially when compared to other food commodities, such as cereals and oil crops.

The expansion in international trade of pulses has provided a good opportunity for several countries to expand their exports. China, Myanmar and Argentina, among developing countries, and Canada, U.S. and Australia among developed countries have emerged as major exporters of pulses. It is noteworthy that despite their growing trade deficit, developing countries as a group increased the exports of focused pulse crops by 37% between mid-1990s and 2006-08.

6. Trends in Consumption of Pulse Crops

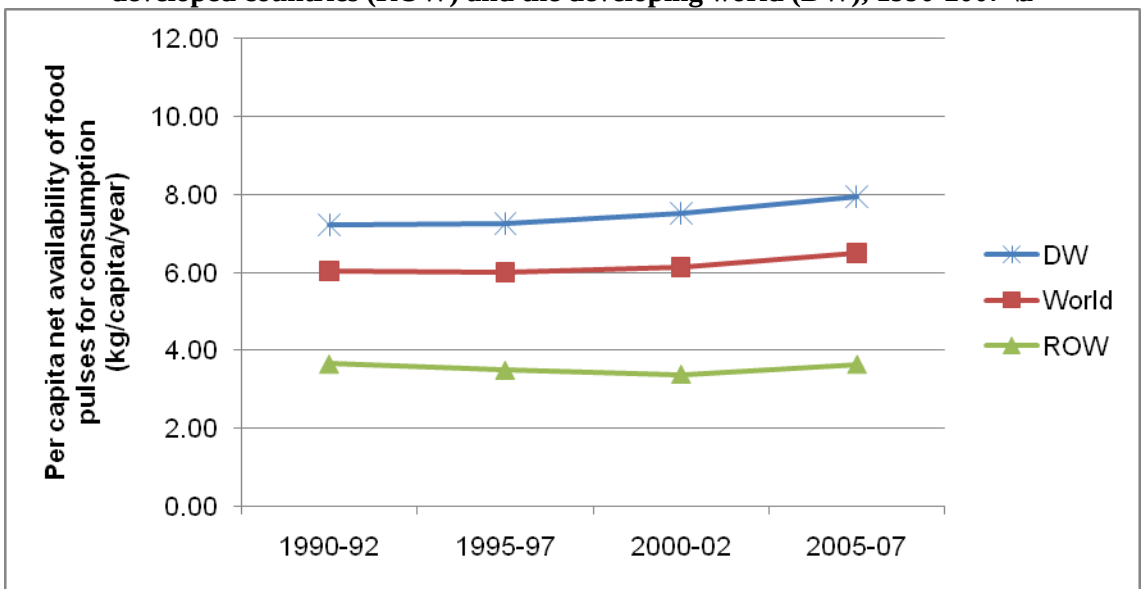
Unfortunately, data on consumption of individual food grains, including pulse crops, is not readily available as that for area, production and trade. For the global and regional analysis, we therefore use two sources of information. The first is the FAO food security statistics website (http://www.fao.org/economic/ess/food-security-statistics/en/) that gives data by country of per capita consumption of food by major categories or groups of food based on the food balance sheets. This data is available for the time period—1990-92, 1995-97, 2000-02 and 2005-07. We use this data for consumption trend analysis for food pulses as a group. Second, we use the data on production and trade to estimate a proxy for average consumption of different pulse crops at a country level by estimating the 'net availability of pulse crop for consumption' as gross production (-) exports (+) imports. This is then divided by the population for a given year to calculate per capita availability of a given pulse grain in kg/year. The per capita net availability of pulse crops estimated using this method should be considered a proxy only. It is not strictly representative of actual level of consumption in the country especially as they do not take in to account any change in stocks in procession of traders, producers and consumers, and also does not subtract the seed and feed use, and wastage of pulse grains after harvest and before consumption.[19] Note that the analysis on consumption pattern and trend does not include soybean in West Africa.

[18] Note that the analysis in this paper excludes dry peas, which is one of the most widely traded pulse crops. In 2006-08 more than 3.7 m tons of dry peas were globally traded, which is more than any other pulse crop.

[19] The data from FAO Food Security website are based on Food Balance Sheet and do take into account these adjustments. Assuming that changes in stocks are minimal for pulses, the estimates of per capita availability of

Figure 37 presents the trend in average per capita availability of food pulses for consumption[20] in the developing world (DW), rest of the world (ROW or developed countries) and the World from 1990-2007. The average per capita consumption[21] of all pulses in DW is about 8 kg/year,[22] almost double the consumption per capita in ROW. The average per capita consumption has steadily increased in DW since mid-1990s from 7.3 kg in 1995 to 7.94 kg in 2007, representing a growth rate of 0.8% per year (Figure 37). This rate of growth in per capita consumption of pulse crops in DW is double the growth rate in ROW (0.4%/year). However, this stagnant or modest positive trend observed since mid-1990s is only a snapshot of a relatively positive era for pulses. Historical data since 1970 on per capita production and consumption of pulses show a rapidly declining trend in decades earlier (Figure 38). Thus, one should keep in mind that the overall positive story on consumption trend presented in this study (given the study's focus from mid-1990s), when viewed from a long-term perspective may indicate declining trends in per capita pulse consumption.

Figure 37: Trend in per capita availability of food pulses for consumption: Comparison between developed countries (ROW) and the developing world (DW), 1990-2007 \a



\a Includes all food pulses as defined by FAO (source: FAO Food Security Statistics)

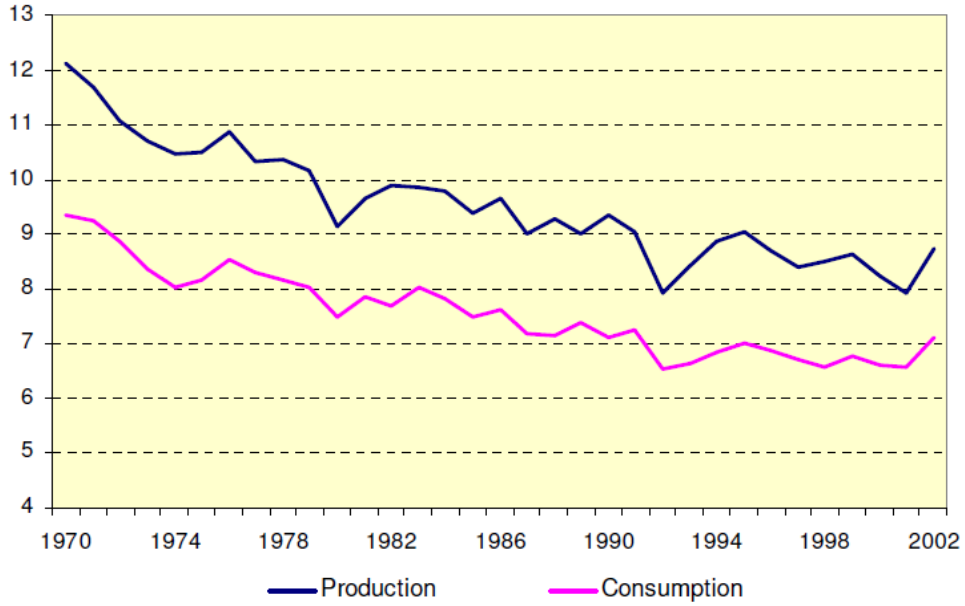
focused pulse crops presented in this study may be an overestimation by a factor equivalent to[total domestic use/available supply]. Thus, the estimates based on these two different methods are not strictly comparable.

[20] In short, this proxy indicator is also referred simply as 'per capita consumption.'

[21] The average for a given region is a simple average of country level reported per capita consumption. It is not weighted by the population of countries in the region.

[22] For comparison purpose the average per capita consumption of cereal crops in the world is more than 50 kg/year. It ranges from more than 65 kg/year in CA, MENA and SEA, about 60 kg/year in SA, and just over 40 kg/year in the LAC region.

Figure 38: Historical view of per capita production and consumption of pulse crops (kg/person/year), 1970-2002



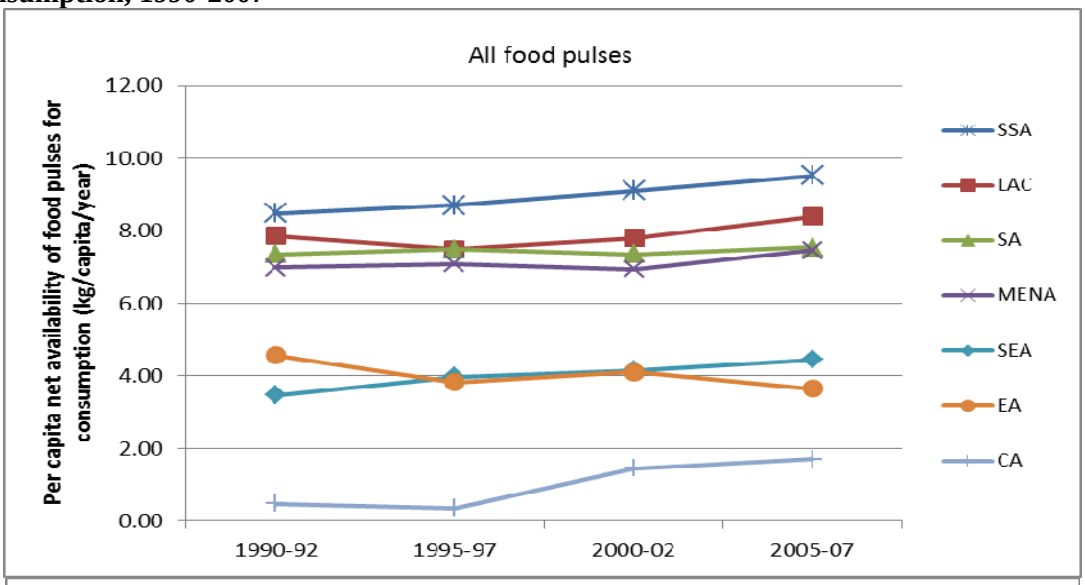
Source: BenBelhassen (2005)

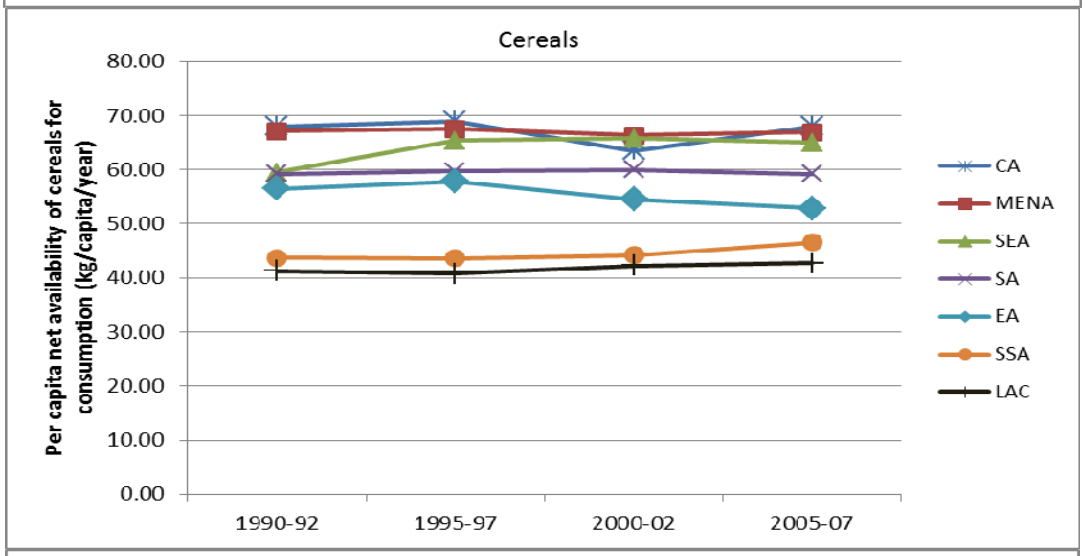
Figure 39 depicts the regional trend in per capita consumption of pulse crops from 1990 to 2007 and comparative trends in per capita consumption of cereals and animal source food (i.e., meat, fish and eggs). Within the DW, there is a great diversity in the quantity of pulses available for consumption by the population. The DW regions fall into two distinct groups in terms of level of per capita consumption of pulse grains. At the lower end, the regions of CA, EA and SEA have per capita consumption of pulse grains in the range of 1-4 kg/year, similar to the average consumption in developed countries (Figure 39). On the higher end of the spectrum, the SSA, SA, LAC and MENA regions have almost two times the level of per capita consumption of pulse grains compared to other regions.

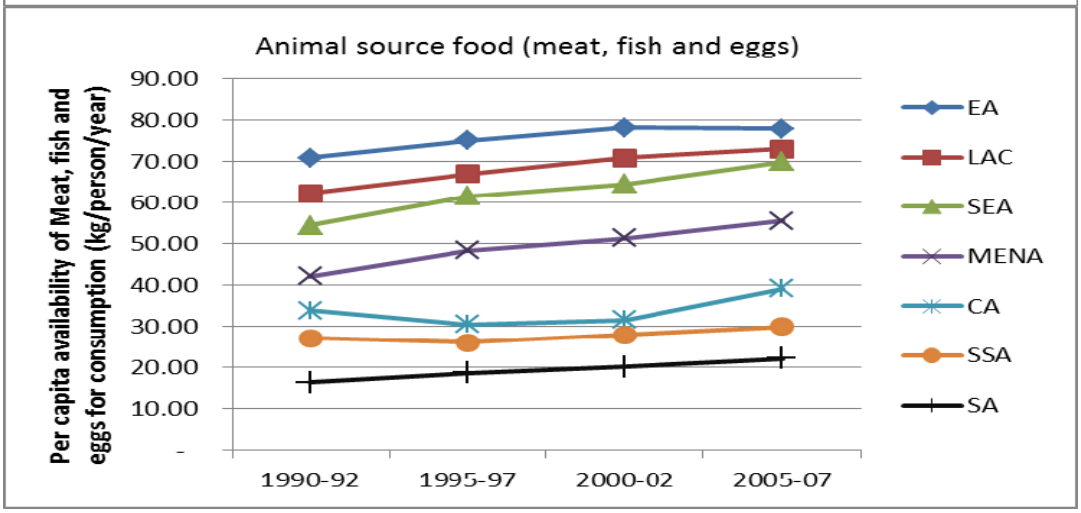
At the higher end of the spectrum, both SSA and LAC have seen a steady increase in per capita consumption of 0.8%/year and 0.4%/year, respectively. Per capita consumption has increased only modestly in SA at a rate of 0.16%/year since 1990. The regions at the lower end of the spectrum have seen mixed trends, with EA experiencing a decline in per capita pulse consumption, SEA experiencing a robust growth rate of 1.68%/year and CA experiencing a sharp increase (8.7%/year), especially after the breakdown of the Soviet Union (mid-1990s) (Figure 39).

Compared to pulses, the trend in per capita net availability of cereals has either remained stagnant or declined in most DW regions from 1990-2007 (Figure 39). The only exception is the SEA region which has experienced an increase in per capita net availability of cereals for human consumption during the last 17 years. For animal source food such as meat, fish and eggs, over the same time period (1990-2007), there is a clear upward trend in per capita availability of these food items for consumption in all the developing regions. There is a wide disparity in the level of per capita availability of animal source food among developing regions with SA and SSA, two top pulse consuming regions at the low end and East Asia, one of the fast declining pulse consuming regions at the high end of per capita consumption of animal source food (Figure 39). LAC is the only developing region with both a high per capita consumption of pulses as well as animal source food.

Figure 39: Regional trends in per capita availability of food pulses, cereals and animal source food for consumption, 1990-2007







Source: FAO Food Security Statistics

Table 14 gives the change in per capita availability for consumption of major pulse crops focused in this study from mid-1990s to 2008. These data are calculated by the authors based on the second method that uses production and trade data, and uses different time periods for trend analysis than those presented in Figures 37 and 39. As such, these data are not strictly comparable and there are slight differences in the size and level of change in average per capita 'consumption' of pulse grains reported in Table 14 and those in Figures 37 and 39. However, the relative size and rank of different regions in per capita consumption of pulse crops is the same. Moreover, the world average per capita consumption of six focused food legumes (dry beans, chickpea, cowpea, lentils, faba bean and pigeon pea) comes to about 6.8 kg/year in 2006-08 (Table 14), which is in the ballpark of the world average per capita consumption of all pulses of 6.5 kg/year in 2005-07 (Figure 37) using the FAO Food Security Statistics website data.[23]

The per capita consumption of dry beans is the highest among all pulses, averaging 3 kg/year in 2006-08, with LAC reporting the highest level of per capita consumption (11 kg/year), followed by SSA (5 kg/year). Chickpea is the next biggest consumed pulse crop, averaging 1.3 kg/year worldwide in recent years. South Asia and MENA are the most significant consumers of chickpea, averaging 4.25 kg/year and 2.11 kg/year, respectively in 2006-08 (Table 14), although both these regions have seen a decline in per capita consumption over the last 14 years. Cowpea is the third important pulse crop consumed on a per capita basis globally (0.8 kg/year) (Table 14). It is also the pulse crop that has seen the largest increase in per capita consumption over the last 14 years, up by almost 60% from the level in 1994-96. Not surprisingly, per capita consumption of cowpea is the highest in SSA (6.5 kg/year) and it has also experienced the highest growth rate in net availability for consumption (Table 14).

Average per capita consumption of other pulse crops—faba bean, pigeon pea and lentils range from 0.5 to 0.6 kg/year in 2006-08 (Table 14). The Middle East and North Africa region has the highest per capita consumption of faba bean and lentils, and the South Asia region has the highest consumption per capita of pigeon pea. Overall, MENA, EA, SA and LAC have seen a decline (in the range of 2-9%) in per capita consumption of these six pulse crops from 1994 to 2008 (Table 14). Similarly, average consumption of faba beans and chickpea across the world has declined slightly from mid-1990s to late-2000s.

Figure 40 visually presents the per capita net availability of major food pulses for consumption by regions in 2006-08 time period. As can be seen, per capita consumption of the six pulse crops as a group in SSA, LAC, SA, and MENA is above the world and DW average, and for SEA, EA, CA and ROW it is below the world and DW average. The figure also helps visualize the diversity of pulses consumed in different parts of the world and their relative importance in the diets of the people in developing countries relative to developed countries (ROW). Among all the food pulses, *Phaseolus* beans of all types (referred by FAO and in this paper as dry beans) are the most ubiquitously consumed in all the regions of the world—both DW and ROW. On the other hand, other food legumes are important part of the pulse consumption basket in some regions but not all. For example, cowpeas are important and consumed mostly in SSA[24], lentils in MENA, SA and LAC, faba bean in MENA, EA, SSA and ROW, pigeon pea in SA, SEA and SSA, and chickpea in SA, MENA, SEA, SSA and ROW (Figure 40).

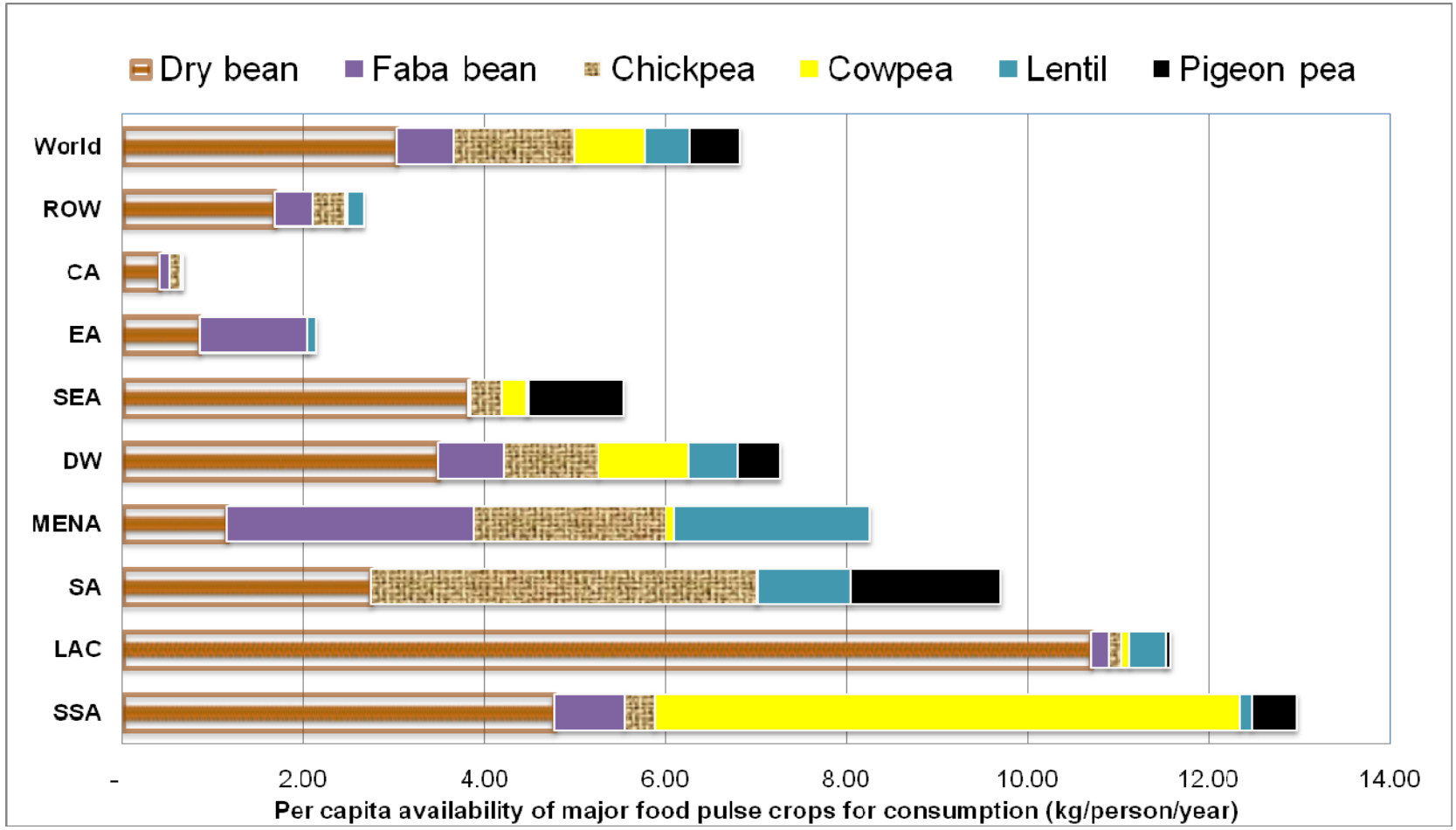
[23] The estimated per capita consumption of pulse crops reported in Table 14 may be a bit overestimated by not excluding the seed use, feed use and wastage.

[24] Note that the agricultural production and trade statistics do not provide data for cowpea in South Asia region and Brazil, where experts believe it to be widely grown and consumed. See Table 6 and Annex 2 for a 'back-of-the-envelope' calculations of disaggregating dry bean area into 'common bean' and 'other types of beans.'

Table 14: Change in per capita availability of major pulse crops for consumption by regions, 1994-96 to 2006-08

	SSA	MENA	SEA	EA	SA	CA	LAC	ROW	WORLD
	Dry Bean								
1994-96 (kg/person/year)	3.90	1.19	2.69	0.98	2.88	0.22	11.12	1.91	2.91
2006-08 (kg/person/year)	4.76	1.15	3.82	0.85	2.75	0.41	10.70	1.69	3.03
Change (1994-2008) (%).	0.86	-0.05	1.13	-0.13	-0.13	0.19	-0.42	-0.23	0.12
% Change	22%	-4%	42%	-13%	-5%	87%	-4%	-12%	4%
Growth rate (%/year)	1.67%	-0.33%	2.97%	-1.17%	-0.39%	5.36%	-0.32%	-1.04%	0.34%
	Chickpea								
1994-96 (kg/person/year)	0.34	2.57	0.17	0.00	4.94	0.10	0.27	0.22	1.42
2006-08 (kg/person/year)	0.33	2.11	0.35	0.01	4.25	0.12	0.13	0.35	1.33
Change (1994-2008) (%).	0.00	-0.46	0.18	0.00	-0.69	0.02	-0.14	0.13	-0.09
% Change	-1%	-18%	110%	183%	-14%	22%	-51%	59%	-6%
Growth rate (%/year)	-0.12%	-1.63%	6.40%	9.07%	-1.25%	1.70%	-5.74%	3.95%	-0.54%
	Cowpea								
1994-96 (kg/person/year)	4.72	0.02	0.07	0	0.01	0	0.07	0.03	0.49
2006-08 (kg/person/year)	6.46	0.1	0.26	0	0.01	0	0.1	0.03	0.78
Change (1994-2008) (%).	1.74	0.08	0.19	0.00	0.00	0.00	0.03	0.00	0.29
% Change	37%	400%	271%		0%		43%	0%	59%
Growth rate (%/year)	2.65%	14.35%	11.56%		0.00%		3.02%	0.00%	3.95%
	Faba bean								
1994-96 (kg/person/year)	0.6	2.6	0.03	1.24	0	0.13	0	0.57	0.64
2006-08 (kg/person/year)	0.78	2.74	0.03	1.19	0	0.12	0.2	0.42	0.63
Change (1994-2008) (%).	0.18	0.14	0.00	-0.05	0.00	-0.01	0.20	-0.15	-0.01
% Change	30%	5%	0%	-4%		-8%		-26%	-2%
Growth rate (%/year)	2.21%	0.44%	0.00%	-		-0.66%		-2.51%	-0.13%
	Pigeon pea								
1994-96 (kg/person/year)	0.39	0	0.3	0	1.81	0	0.08	0	0.49
2006-08 (kg/person/year)	0.51	0	1.06	0	1.66	0	0.05	0	0.56
Change (1994-2008) (%).	0.12	0.00	0.76	0.00	-0.15	0.00	-0.03	0.00	0.07
% Change	31%		253%		-8%		-38%		14%
Growth rate (%/year)	2.26%		11.09%		-0.72%		-3.84%		1.12%
	Lentils								
1994-96 (kg/person/year)	0.10	2.17	0.03	0.05	0.98	0.02	0.34	0.36	0.48
2006-08 (kg/person/year)	0.13	2.16	0.02	0.09	1.03	0.03	0.40	0.18	0.49
Change (1994-2008) (%).	0.04	-0.02	-0.01	0.03	0.05	0.02	0.07	-0.18	0.01
% Change	37%	-1%	-41%	57%	5%	109%	21%	-49%	2%
Growth rate (%/year)	2.68%	-0.07%	-4.27%	3.81%	0.40%	6.33%	1.57%	-5.53%	0.17%
	Total (all above pulses)								
1994-96 (kg/person/year)	10.05	8.56	3.28	2.28	10.62	0.46	11.87	3.09	6.43
2006-08 (kg/person/year)	12.98	8.25	5.54	2.14	9.70	0.68	11.58	2.67	6.82
Change (1994-2008) (%).	2.93	-0.30	2.25	-0.15	-0.92	0.22	-0.29	-0.42	0.39
% Change	29%	-4%	69%	-6%	-9%	47%	-2%	-14%	6%
Growth rate (%/year)	2.16%	-0.30%	4.45%	-	-0.76%	3.28%	-0.21%	-1.22%	0.49%

Figure 40: Per capita net availability of major food pulses for consumption by regions, 2006-08



Source: Calculated by authors based on production and trade data from FAO as explained in the text.

Table 15 gives a list of 50 top pulse producers in the world and provides country level data on average per capita production and consumption of all food pulses. This list of 50 top producers covers 95% of world pulse crop production in 2006-08. With a share of 28%, India is on the top of this list and way ahead of any other country in terms of quantity of food pulse production. However, India is not the highest pulse consuming country on a per capita basis. The average annual per capita consumption in India is estimated to be about 11.7 kg in 2005-07 based on FAO data.[25] This is higher than the average for the DW, but it is not as high as in many other smaller pulse producing countries such as Niger, Burundi, and Rwanda. These three countries have the highest per capita consumption of pulse crops in the world with an estimate of per capita availability of pulse grains for consumption of 34 kg in Niger and Burundi and 27 kg in Rwanda. The other countries with estimates of annual per capita consumption of all pulse crops in upper teens include Uganda (19 kg), Nicaragua (18 kg) and Brazil (16 kg). China, which is the world's second biggest producer of food pulses, has one of the lowest per capita consumption (Table 15). Thus, the point about the data presented in Table 15 is that there is no one-to-one correlation between the quantities of pulse crops produced (and thus the rank of a country) and per capita consumption. Because size of the country in terms of population is an important factor in calculating per capita consumption, the consumption per capita is better correlated with per capita production than volume of production per se.

It is interesting to put this overall modest positive trend in per capita consumption of pulse crops in perspective by examining the change in dietary patterns around the world over the past 14 years. Diets evolve over time, being influenced by many factors and complex interactions. Income, prices, individual preferences and beliefs, cultural traditions, as well as geographical, environmental, social and economic factors all interact in a complex manner to shape dietary consumption patterns. Food consumption expressed in kilocalories (kcal) per capita per day is a key variable used by the World Health Organization (WHO) for measuring and evaluating the evolution of the global and regional food situation. Analysis of FAOSTAT data shows that dietary energy measured in kcals per capita per day has been steadily increasing on a worldwide basis; availability of calories per capita from the mid-1990s to 2007 increased globally by approximately 160 kcal per capita per day (about 6%) and by about 157 kcal per capita per day in developing countries (7%). Globally, the share of cereals as a contributor to this per capita calorie intake over the past 14 years has declined whereas the share of pulse crops has remained more or less steady (Figure 41). In developing countries, the contribution of cereals to per capita calorie consumption has declined in all the regions, with the most decline observed in EA and CA (6%) and the least decline in MENA (0.4%). As against this, the contribution of pulse crops to total per capita calorie consumption in developing regions has remained steady (SSA, SA, SEA) or increased (LAC, MENA and CA). The only region experiencing a declining share of pulse crops in total calorie intake over the past 14 years is EA (Figure 41).

[25] The last estimate of per capita consumption of pulses in India available based on household survey conducted by the National Sample Survey (NSS) Organization is 8 kg in rural areas and 9.4 kg in urban areas in 2004-05 period. Given the fact that household level surveys are based on actual consumption data they are more accurate estimates of average quantities actually consumed by people as they are net of any seed, feed use and wastage. The estimates based on FAO used in this study are higher than household survey data, which is expected. This is because the method used in this study to estimate consumption based on FAO data do not exclude seed, feed use and wastage and thus represent a ceiling of average per capita consumption quantities as they represent 'per capita availability of pulse grain for consumption.'

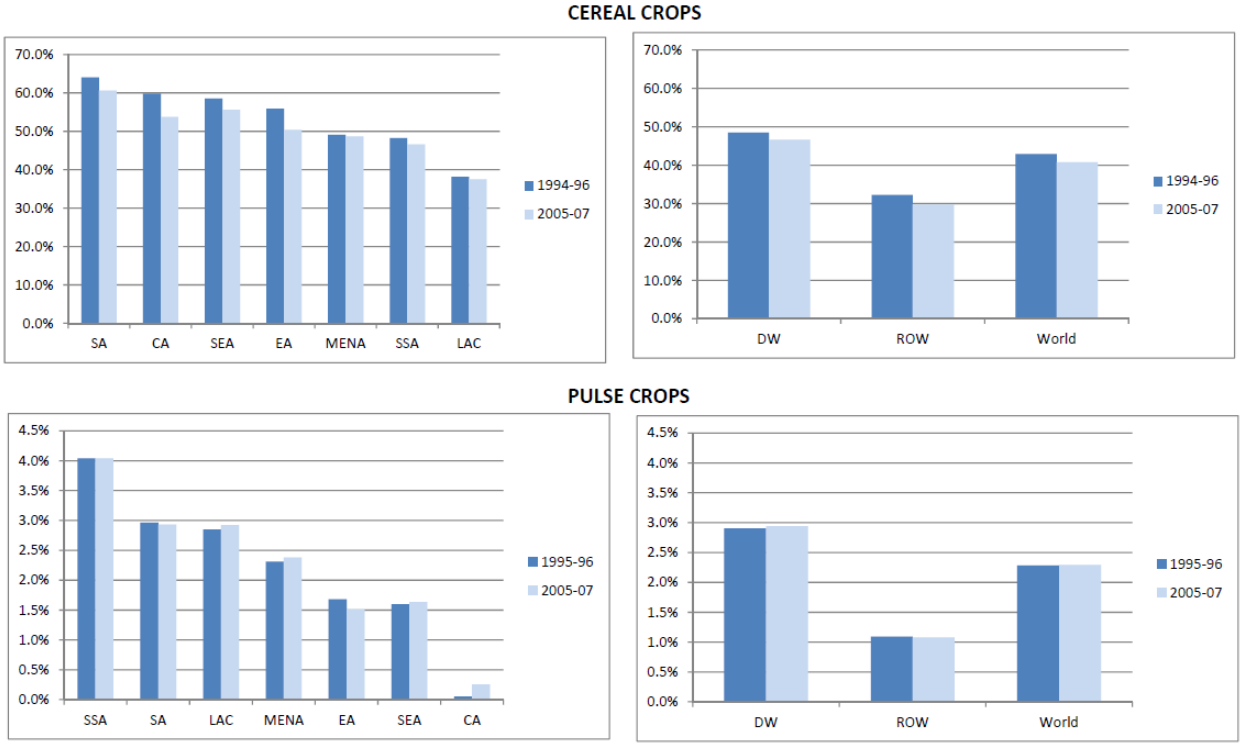
Table 15. Per capita production and consumption of food pulses by top 50 producing countries around the world ranked by total production of food pulses, 2006-08

Rank	Countries	Region codes\a	Average total production of food pulses \b (2006-08) ('000 tons)	Percentage share in world production	Cumu-lative % (on a scale of 0-1)	Per capita production of food pulses \b (2006-08) (kg/year)	Per capita availability for consumption of all pulses \c (2005-07) (kg/year)
1	**India**	SA	13,616.43	0.28	0.28	11.65	11.68
2	**China**	EA	3,632.54	0.07	0.35	2.71	1.10
3	**Myanmar**	SEA	3,511.50	0.07	0.42	71.31	15.70
4	**Brazil**	LAC	3,404.99	0.07	0.49	17.87	16.06
5	**Nigeria**	SSA	2,970.50	0.06	0.55	19.99	9.86
6	**Mexico**	LAC	1,350.71	0.03	0.58	12.54	12.78
7	**USA**	ROW	1,342.77	0.03	0.61	4.34	4.38
8	**Canada**	ROW	1,316.33	0.03	0.63	39.86	7.30
9	**Niger**	SSA	1,235.98	0.03	0.66	86.50	33.95
10	**Ethiopia**	SSA	1,234.63	0.03	0.68	15.59	15.33
11	**Turkey**	MENA	1,084.89	0.02	0.71	14.81	11.32
12	**Tanzania**	SSA	1,079.38	0.02	0.73	25.95	15.33
13	**Pakistan**	SA	877.45	0.02	0.74	5.04	6.57
14	**UK**	ROW	702.25	0.01	0.76	11.47	2.92
15	**Australia**	ROW	632.53	0.01	0.77	30.25	1.46
16	**Uganda**	SSA	603.30	0.01	0.78	19.52	18.62
17	**Kenya**	SSA	549.67	0.01	0.80	14.46	15.70
18	**Iran**	MENA	541.17	0.01	0.81	7.45	6.94
19	**Malawi**	SSA	366.65	0.01	0.81	25.21	13.14
20	**Egypt**	MENA	361.56	0.01	0.82	4.50	8.03
21	**Argentina**	LAC	353.33	0.01	0.83	8.92	1.46
22	**Cameroon**	SSA	352.73	0.01	0.84	18.79	14.24
23	**Burkina Faso**	SSA	344.96	0.01	0.84	23.22	13.87
24	**Indonesia**	SEA	325.34	0.01	0.85	1.44	1.46
25	**France**	ROW	317.06	0.01	0.86	5.13	1.83
26	**Rwanda**	SSA	307.10	0.01	0.86	32.24	27.01
27	**Sudan**	SSA	305.01	0.01	0.87	7.50	8.03
28	**D P R Korea**	EA	300.00	0.01	0.87	12.63	11.68
29	**Viet Nam**	SEA	255.00	0.01	0.88	2.95	2.56
30	**Nepal**	SA	248.12	0.01	0.88	8.73	8.76
31	**Bangladesh**	SA	224.78	0.00	0.89	1.42	4.02
32	**Morocco**	MENA	210.35	0.00	0.89	6.72	6.94
33	**Burundi**	SSA	207.93	0.00	0.90	26.33	33.95
34	**Thailand**	SEA	193.05	0.00	0.90	2.88	2.19
35	**D R Congo**	SSA	184.93	0.00	0.91	2.94	3.29
36	**Peru**	LAC	181.80	0.00	0.91	6.36	7.30
37	**Poland**	ROW	181.56	0.00	0.91	4.76	1.83
38	**Nicaragua**	LAC	175.87	0.00	0.92	31.33	18.25
39	**Syria**	MENA	170.31	0.00	0.92	8.23	6.57
40	**Colombia**	LAC	168.94	0.00	0.92	3.79	6.94
41	**Benin**	SSA	162.95	0.00	0.93	19.26	13.14
42	**Mozambique**	SSA	154.25	0.00	0.93	7.01	5.48
43	**Guatemala**	LAC	144.27	0.00	0.93	10.74	9.49
44	**Russian Fed.**	ROW	129.07	0.00	0.94	0.91	1.83
45	**Italy**	ROW	117.00	0.00	0.94	1.97	5.48
46	**Angola**	SSA	113.16	0.00	0.94	6.40	6.21
47	**Chad**	SSA	112.84	0.00	0.94	10.55	9.86
48	**Belarus**	ROW	108.49	0.00	0.94	11.17	NA

Rank	Countries	Region codes\a	Average total production of food pulses \b (2006-08) ('000 tons)	Percentage share in world production	Cumu-lative % (on a scale of 0-1)	Per capita production of food pulses \b (2006-08) (kg/year)	Per capita availability for consumption of all pulses \c (2005-07) (kg/year)
49	**Madagascar**	SSA	99.78	0.00	0.95	5.33	5.11
50	**Spain**	ROW	98.71	0.00	0.95	2.24	4.38

\a Region codes: CA=Central Asia; EA=East Asia; LAC=Latin America and the Caribbean; MENA=Middle East and North Africa; SA=South Asia; SEA=South East Asia; SSA=Sub-Saharan Africa; ROW=Rest of the world (relative to the developing world);
\b includes the following pulse crops: dry bean, chickpea, cowpea, lentil, pigeon pea, faba bean and pulses, nes.
Source: Calculated by author from FAOSTAT data (accessed February 2011)
\c Source: http://www.fao.org/fileadmin/templates/ess/documents/food_security_statistics/FoodConsumptionFoodGroups_en.xls. Includes all food pulses as defined by FAO food category "pulses" (dry bean, chickpea, cowpea, lentil, pigeon pea, faba bean, pulses, nes, bambara beans, lupins, dry peas and vetches)

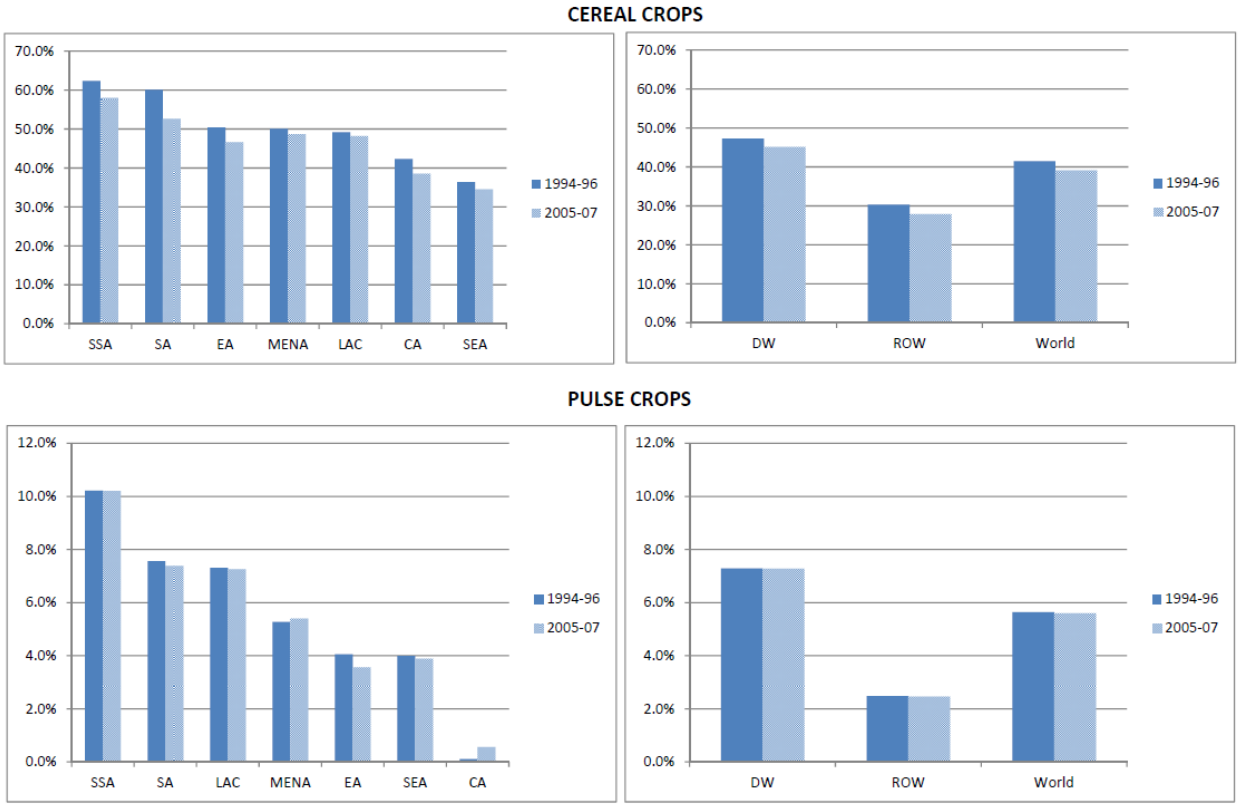
Figure 41: Change in per capita calorie contribution from cereals and pulses as a percentage of total calorie intake, 1994-96 to 2005-07



Source: Calculated by authors based on FAOSTAT data

For cereals, the picture is more or less the same when it comes to its contribution to total per capita protein intake (Figure 42). All the regions of the world have seen the share of cereals in per capital protein consumption decline over the last 14 years. As against this, the contribution of pulse crops to total per capita protein consumption in developing regions has been mixed—it has increased in MENA, SEA and CA, remained steady in SSA and LAC, and declined in SA and EA, the two regions that have seen rapid economic growth in the last 15 years (led by India and China).

Figure 42: Change in per capita protein consumption from cereals and pulses as a percentage of total dietary protein consumed, 1994-96 to 2006-08



Source: Calculated by authors based on FAOSTAT data

The data on calorie and protein consumption presented in Figures 41 and 42 suggests that dietary patterns are changing all over the world and the share of non-cereal foods (i.e., vegetables, fruits, dairy and meat) in the total calorie and protein consumption is increasing. However, at least over the past 14 years, pulses have not seen a dramatic decline in the total calorie and protein contribution to an increasing quantity of food basket consumed globally as seen by the cereal crops. But with the rapid economic growth in EA and SA, the declining share of pulses in total protein intake observed in those two regions may be indicative of what's ahead for other regions as they experience rapid increase in per capita income.[26]

Most of the information on food consumption presented above has been obtained from national Food Balance Sheet data (from FAO) and represent 'net availability' of pulses for consumption. In order to better understand consumption patterns, it is crucial to obtain more reliable information on actual food consumption patterns and trends based on representative consumption surveys done over time. One of the countries where such survey is routinely done is India, which incidentally is the largest pulse producing and consuming countries in the world. Annex 7 presents some pertinent data to analyze the consumption and expenditure pattern and trend of pulses and other food items in India to get a closer look at what's happening in one of the largest pulse producing country in the last 15 years. Here, we summarize the

[26] The case of India, one of the countries in SA that has experienced rising real incomes in recent decades, is however, puzzling. The household level consumption data show a decline in total calories and protein consumed over the last 20 years by rural Indian population, even though the real incomes have increased and the consumption of other sources of food has increased (Deaton and Dreze 2009).

major points emerging from the data and analysis presented in Annex 7 and see if the experience of India is applicable to the developing world.

6.1 Pulse consumption in India: Trends and patterns emerging from household level surveys

Over the past 20 years, the rate of increase in pulse production in India has been less than the growth rate in population. As a result, the per capita production of pulse crops continued a downward trend observed in previous decades and declined from 14 kg in mid-1990s to 12 kg in 2008. The declining per capita production has been compensated by increasing imports of pulse crops following the liberalization of pulse import policies in late-1990s. The availability of imported pulses has had some impact in stabilizing the price of pulse crops in recent decade; but the price of pulses continued to rise faster than that of cereals, eggs, meat and fish in the years 2000 to 2010 (Swamy 2010).

As a result of the surging population, stagnating pulse production, and rising pulse prices (relative to other commodities), per capita availability of pulses for consumption in India has continued the declining trend observed since1950s. But the rate of decline in per capita availability of pulses has slowed down in the last 20 years, and especially since 2000.

The data from nationally representative household surveys conducted by the National Sample Survey Organizaiton (NSSO) indicate that per capita consumption of pulse crops has declined across most pulse types and among both rural and urban population from 1993 to 2004. The average per capita consumption of all pulses in 2004-05 was estimated at 8.5 kg/year in rural areas and 9.9 kg/year in urban areas.[27] Here are some of the major results from the NSS data that were available to the authors from the 'thin' surveys upto 2007-08 and 'thick' surveys upto 2004-05.

- The per capita consumption of cereal crops (esp., coarse grains) since 1993 has dropped more steeply then the per capita consumption of pulses.

- The declining per capita consumption of cereal and pulses has led to their declining importance as a source of calories and protein in Indian diets, which according to some analysis based on the NSS data, has come concomitantly with a decline in average per capita calorie and protein consumption in rural India and a stagnant level of those nutritional indicators for urban India (Deaton and Dreze 2009).

- The results of trend analysis for pulses are mixed and not as clear-cut across all income groups as they are for cereals. The share of pulses in total calories consumed has declined by 10% and 13% respectively for non-poor lower and non-poor higher income groups, but for 'moderately poor', it has only declined modestly, and for the 'very poor' the caloric contribution of pulses has in fact increased by 6% from 1993 to 2004.

- The share of pulses in total calorie consumption in 2004 ranged from 3.4% for the 'very poor' to 4% for 'non-poor higher' income groups. In both the years, the share of pulses in total calories consumed increased with the level of income. This positive correlation between pulse' contribution to total calories consumed and level of income is opposite of the correlation between cereals' contribution to total calories and income level. In fact, all other categories of food show a positive correlation with income, except cereal crops.

[27] At least for India, this observation is a rejection of the hypothesis that urbanization leads to declining consumption of pulses.

- Most of the decline in the share of cereals in calorie consumption between 1993-2004 has come from a concomitant increase in the share of vegetables and fruits across all income groups. A puzzling fact is that even though the quantities of milk, eggs and chicken meat have increased for all income groups in both rural and urban areas from 1993 to 2004, their share in total calories consumed has not increased significantly. The only other category that has seen its contribution to total calorie consumption increase between 1993-2004 is 'other food,'composed of expensive caloric items such as edible oil, snacks and refreshments, but which are not necessarily high in nutritional value.

- The decline in the share of cereals in total food expenditure basket is also much more dramatic (55% and 68% decline from the 1st decile to the 10th decile in the rural and urban areas, respectively) than for pulses (13% and 39% decline from the 1st to the 10th decile in the rural and urban areas, respectively). With the rise in income (measured by the level of 'monthly per capita consumption expenditure' or MPCE), the share of milk and milk products in total food expenditure has increased at a much higher rate than any other food category. With increasing income, the share of 'all other' foods (i.e., beverages, spices, snacks, edible oil, sugar, etc.) in food expenditure basket has also increased to the level that in 2007-08, it had become the most expended food category (replacing cereals) in the highest decile group in both rural and urban areas.

- The relative importance of meat and animal products in monthly food expenditure does not show a big increase from lower to the higher end of the MPCE distribution group in urban areas; but it does show a big increase in the rural areas. Overall, the highest decile group of consumers spend less than 10% of their total expenditure on meat and animal products (including, eggs and fish). Thus, despite higher income, there does not seem to be a significant shift towards more expensive and high-value protein foods, even as the consumption of less expensive sources of calories and protein in the form of cereals and pulses has declined.

- Across all decile groups, the share of pulses in the total food expenditure in 2007-08 averaged 6.1% in rural areas and 5.7% in urban areas, which was a slightly smaller share than for meat and animal products in total expenditure (6.5% in rural and 6.8% in urban areas). However, among the lowest two decile groups, the share of pulses in total food expenditure is higher than the share of meat and animal products. Thus, next to cereals, pulses still remain the main source of protein for the lower expenditure classes.

The household level survey data for India thus provide insights on per capita consumption behavior for pulses in the context of the changing dietary, consumption and food expenditure patterns observed since mid-1990s. Some of the emerging trends from India's experience that may be more generalizable to the developing country context are: a) the declining share and importance of cereals in total calorie consumption, as consumption of other categories of food, esp., vegetables, fruits, edible oil and meat increases; b) the gradual decline in the share of pulses in the average dietary basket, while still remaining an important source of protein and other nutrients for the poor segments of the society; c) the increase in quantities of pulses consumed as incomes rise, but a declining share in the total food expenditure.

However, the following two findings from the household level consumption data from India are anomalies for which more evidence from other countries is needed to determine whether they are norms or exceptions to the norm. The first is the evidence of declining or a stagnant per capita calorie and protein consumption despite increasing real income observed in India. In other developing countries that have observed similar or higher income growth rate (i.e., China, Brazil), the trend has been an increase in

per capita calorie consumption and a shift to high-value proteins.[28] The projections by FAO and WHO of total calorie and protein consumption for developing countries as a group, are more in line with the experience that China and Brazil have had than the evidence found in India.[29] Another trend (or lack of a trend) found in India, which is contrary to expectations is that the surveys find no significant level or rate of decline in per capita pulse consumption between rural and urban population. In fact, the data shows the average per capita consumption of pulses is higher in urban than in rural population. This pattern may not hold in other regions and for some types of pulses (such as common beans in Latin America), where the decline in pulse consumption is associated with increasing urbanization and the level of consumption drop when people move from rural to urban areas (Leterme and Munoz 2002).

7. Future Outlook for Pulse Crops

Although, the data and analysis presented in this paper has shown a stable or a modest positive trend in per capita consumption of pulse crops since mid-1990s, the overall historical trend has been one of a steady decline in the world pulse production and consumption per capita (see Figure 38). This has also been the trend in India—one of the largest producer and consumer (and now the largest importer) of pulses. Interestingly, the most drastic drop in India was in the 1960s-1970s, when the "Green Revolution" resulted in big yield improvements in cereal grains, which made those crops more competitive on farms.

According to Stat Publishing's analysis, the declining historical trend in per capita consumption is expected to continue into the future because of the following driving forces which are projected to persist in developing countries (Clansey 2009):

- **Reduction in pulse production** as a result of increased competition for farm land use from other crops and government policy aimed at moving farmers into more visible "food security" crops and bio-energy uses.
- **Increasing imports:** As production falls behind domestic needs, imports will rise. Imported pulses are not always cheaper and do not always meet the consumers' preferences for color, flavor and cooking characteristics as locally grown pulses. This can drive down overall per capita usage rates. Relying on imports also leaves countries vulnerable to supply shocks, which can periodically have a negative effect on the amount people buy and consume.
- **Rising incomes:** Increase in income does not always have a positive impact on demand for traditional foods, which may include pulses. Initially, higher incomes allow people to buy more basic foods, stimulating demand. Once discretionary income grows, eating habits change and new patterns evolve, typically resulting in some movement away from traditional foods.

As noted by some analysts, urbanization may also have a negative effect on pulse consumption per capita and may be an additional driver for inducing the declining trend. However, on the positive side, environmental benefits and the nutritional value of pulses are their marketing/selling points, and in the

[28] In Brazil, another important pulse producing and consuming country, annual pulse consumption has fallen from 26 kg/person in 1970 to just 15 kg/person in 2009 (USDA-FAS 2010). Based on the Food Balance Sheet approach, FAO data shows that from 1994 to 2007, per capita calorie consumption/availability increased by 240 kcal in China and 290 kcal in Brazil. For this same time period the per capita consumption of protein in the average diet increased by 12 gm/person/year in China and 13 gm/person/year in Brazil. These levels of protein consumption increases were more than double the average levels for the developing countries or the world.

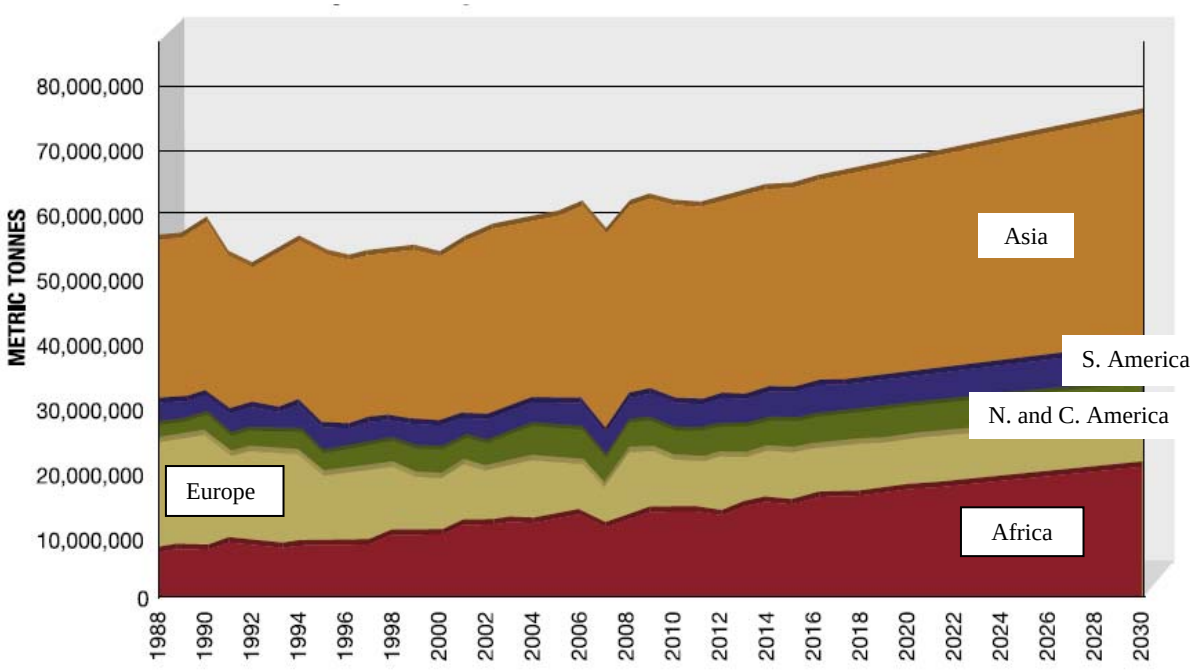
[29] See the discussion on the global and regional food consumption patterns and trends on WHO's website: http://www.who.int/nutrition/topics/3_foodconsumption/en/index4.html (accessed March 2011).

future these arguments are likely to be increasingly used by the global pulse industry which can help reverse or at least slow down the declining trend in pulse consumption and production.[30]

Based on these negative and positive forces occurring in the developing as well as the developed countries, the projection, therefore, is for the continuation of a declining trend in the overall pulse consumption per capita but at a slower rate than in the past few decades. Based on this trend and the projected different country-specific rates of population growth, Clansey (2009) projects import needs to grow. Overall, pulse consumption is expected to grow 10% in the coming decade and 23% from current levels by the year 2030. Consumption is expected to grow most rapidly in Asia and Africa (Figure 43). This project demand growth in Africa and Asia is consistent with the analysis by Rao et al. (2010) which projects doubling of the demand for chickpea and pigeon pea in these two regions.

According to Clansey (2009), pulse consumption in Africa could rise 27% within the next decade and another 50% by 2030, as a direct consequence of the forecasts in the region's population growth. Clansey further contends that if civil unrest and drought remain the features of the African landscape for the coming two decades, imports will continue to be dominated by food aid. On the other hand, if civil unrest moderates and local agricultural output improves, more commercial demand will emerge, may be at the expense of food aid volumes.

Figure 43: World pulse consumption projections (tons)



Source: Clancey 2009

In Asia total pulse consumption is expected to grow 11.6% by 2020 and 23.6% by 2030 (Figure 43). Per capita pulse consumption is expected to decline slightly from an average 5.5 kg in late 2000s to 5.3 kg in

[30] For example, in the U.S., the US Dry Bean Council is actively promoting an education and awareness program through the "Beans Education and Awareness Network" (B.E.A.N) and providing resources to support the campaign to 'Eat More Beans.' In fact they have adopted 'Beans for Health" as the name for their website (see: http://www.beansforhealth.org/)

the future (Clansey 2009). The analysis by Kumar et al. (2009) (cited in Mruthyunjaya and Kumar, 2009) project the demand for pulse crops in South Asia (comprised of India, Pakistan, Bangladesh, Nepal, Sri Lanka and Bangladesh) to increase from 17.6 million tons in 2005 to 21 million tons by 2015 and to 24 million tons by 2025. This represents an annual growth rate in projected demand for pulses of 1.76% from 2005-2015 and 1.35% from 2015 to 2025. This projected growth rate in demand for pulses is more than the rates projected for any cereal crop (including rice and wheat).

To meet the projected global demand for pulse consumption, pulse production will have to increase in tandem with consumption demand. Making a conservative assumption that expansion of area under pulse crops will continue at the same rate of growth (0.37%/year) over the next decade as observed in the previous 14 years, the projected global demand for pulses (i.e., 10% in the coming decade and 23% from current levels by the year 2030) will have to be met by an increase in average global yields of pulse crops by 70 kg/ha by 2020 and 120 kg/ha by 2030. This may seem a modest goal, but it implies more than 1.5 times the rate of yield gains realized in the past 14 years at a global scale. On the other hand, if we assume that yields will continue to grow at the same rate over the next decade as observed in the past 14 years (i.e., 0.4%/year), then the projected increase in demand for pulses will have to come from an expansion of area in the order of 6 million hectares by 2020 and 9.5 m ha by 2030 on top of the global pulse area harvested in 2008, which was about 72 m ha. Any shortfall in realizing the area growth projected from historical data will have to be compensated by an even higher increase in pulse yields, and vice versa.

Recognizing the importance of increasing domestic production to meet the projected consumption demand for pulses, many governments in major pulse producing countries are taking policy actions in support of the pulse sector. For example, the government of India has taken steps (e.g., raising the minimum support prices) and recently launched the “accelerated pulses production programme (A3P)” to attract more farmers to grow pulse crops using improved practices. To address the disease problem that often plagues bean production systems and lowers their yield, the government of Brazil is supporting a joint project between the Brazilian Agricultural Research Enterprise (EMBRAPA) and Monsanto to develop genetically-modified beans resistant to white mold (USDA-FAS 2010). These actions can have positive impact on boosting the production of pulses in these countries and easing the short-term upward pressure on price. In fact, the forecast for 2010-11 season is that pulse production in India will see a huge rebound, mostly coming from an expansion in area planted in the *kharif* season, which is estimated to be 2 million ha more than last year (Chandrashekhar, 2010).

8. Summary and Conclusions

Food legumes are an important crop as a source of income and nutrition to billions of people around the world. This report set out to examine the global and regional trend in area, production, yield, trade, price and consumption of six major food legumes—dry beans, chickpea, cowpea, lentils, pigeon pea and faba beans, and one oil legume crop—soybean in West Africa. Relative to cereals like wheat, rice, maize, millet and sorghum, pulse crops capture a small share in total agricultural area and production worldwide covering 61 million ha of harvested area in the world with 58 m ha in developing countries and 3 m ha in the developed regions. The global average yield of pulse crops in 2008 is estimated to be about one ton/ha, which is about one-third that of average yields of cereal crops. The low standing of pulse crops relative to cereals in terms of yields and production is reversed when it comes to producer prices. In the last three years (2006-08), average producer price for pulse grains was, on average double the average price for cereal crops in the top pulse producing developing countries and more than three times higher in developed countries. The producer price of pulse crops has seen a dramatic increase in the last few years in many important pulse producing countries and regions of the world. This has been caused both by

shortage of supply (compared to demand) and rising costs underlying the global phenomenon of food and oil crisis witnessed in recent years.

About 15% of the global production of pulse crops studied in this report is traded. Over the past 14 years, the status of developing countries as a group has changed from net exporter to a net importer of pulse crops. Dry beans are the most traded pulse commodities in the world and pulses such as cowpea and pigeon pea are the least traded commodities. In terms of importance of food legumes in regional economies, South Asia is the largest grower, producer and importer of pulse crops and sub-Saharan Africa has the highest per capita availability of pulses for consumption. The following pulse crops are the most important to the producers and consumers of different regions—dry beans in LAC and SSA, cowpeas in SSA, lentils in MENA and SA, chickpeas and pigeon peas in SA and faba beans in MENA. Thus for any future studies focused on in-depth analysis of how these crops contribute to producer welfare, human nutrition and environmental health, it makes sense to include commodity-country combinations from this list.

The role of pulses in human diets is greater than their small quantities suggest due to their high protein and energy content and their use in diets of the poorest people as substitutes for animal products. Common beans, cowpeas, chickpeas, faba beans, lentils and pigeon peas enhance the value of cereal dominated diets as they provide complementary essential amino acids and minerals. Pulses are 'the poor man's meat." The continuing importance of pulses as a source of protein in poor people’s diet is clearly evident from the data presented for India. Given the fact that the consumption of milk, eggs, meat and fish for the lowest income distribution group is still very low in India implies that next to cereals, pulses still remain the main source of protein for the poorest segment of both rural and urban India. This observation is applicable to many other countries in the world.

There is a clear long-term global declining trend in per capita pulse consumption; although this trend seems to be stabilized or modestly reversed in the last 14 years for some of the six pulse crops focused in this study and in developing countries as a group. There has been also a parallel long-term declining trend in per capita cereal consumption in developing countries. The combined declining levels of consumption of cereals and pulses have the potential effect of not only reducing total calorie consumption, but also reducing protein consumption as shown by the evidence from India. The universal shifts away from cereals and pulses observed as a trend in many countries warrants a closer look at household level consumption data in developing countries to monitor whether these declining trends in cereal and pulses are being compensated by an increase in the consumption of other energy and protein rich foods.

On the production front, the country and regional-level data presented in this paper, point to an increasing trend in the average production and yield of pulses as a group since mid-1990s. The trend analysis points to many bright spots in the pulse story of the last decade and a half. First, growth rate in total world pulse production has surpassed the growth rate in global population, and most of this growth has come from increased yields in developing countries. Second, sub-Saharan Africa has experienced one of the highest yield growth rates of pulse crop in the last 14 years; most of which is attributed to the high growth rate in cowpea production. For dry bean, soybean in WA and pigeon peas, the majority contributor to the growth in production has been yields, which is another positive aspect of the pulse story in developing countries. However, the overall picture in developing countries for faba beans, chickpeas and lentils over the last 14 years has not been favorable as these crops exhibited a small positive growth rate (faba beans and chickpeas) or an overall negative growth (lentils) rate mostly due to declining area.

Despite the overall positive trend, the average yields of pulses in developing countries still remain less than one ton/ha. Also, despite the positive story for SSA, that region still remains at the bottom of the list of regions ranked in terms of average pulse yields. Similarly, cowpea remains one of the lowest yielding pulse crops (with less than 0.5 t/ha average yields). Increasing the average yield of all pulse crops thus

remain a major challenge to increase the competitiveness of the pulse sector in developing countries. Low input use, production pushed into marginal areas by expansion of cereal crops, adverse effects of agricultural policy focused on cereal crops for food security, and lack of technology dissemination system to deliver new technologies and improved-cultivars to farmers are often quoted as the causes for low pulse productivity. Recent efforts by large pulse producing countries like India and Brazil to develop and promote technologies and increase pulse productivity are steps in the right direction. But whether these initiatives and programs in large pulse producing countries serve as harbinger of growth for the global pulse sector and whether it will help reverse the decade long downward trend in per capita pulse production and consumption in developing countries remain to be seen.

In the end, we would like to point to two important themes related to pulses that are not covered in this report, which may be important researchable topics. First, pulses can be utilized in many different forms. In some production systems, legumes play a dual role as both a food and a feed crop (e.g., cowpeas in small-holder livestock systems in West Africa)[31] and the seeds can be consumed in the green stage or as a dry grain. In some production systems, the leaves are also consumed as leafy vegetables. These various forms in which pulses are utilized have important implications on the role pulse crops play in meeting the food security, nutrition and income needs of small holder growers in developing countries. Second, and related to the first issue, in many farming systems pulses are considered women's crops and provide an important source of income and meet the family's nutritional needs. The trends and changing patterns in the food vs. feed vs. vegetable use of pulse crops, and the gender dimensions associated with their production, marketing and consumption are policy relevant topics for further research.

[31] Kelley et al. (2000) report that about 27% of the world legume production in mid-1990s was utilized as feed. The share of total pulse utilization in developing regions was highest in East Asia (16%) and lowest in Africa (1.4%). On the other hand, during the same time period in Europe, CIS and Oceania regions more than 70% of legume production was utilized as feed.

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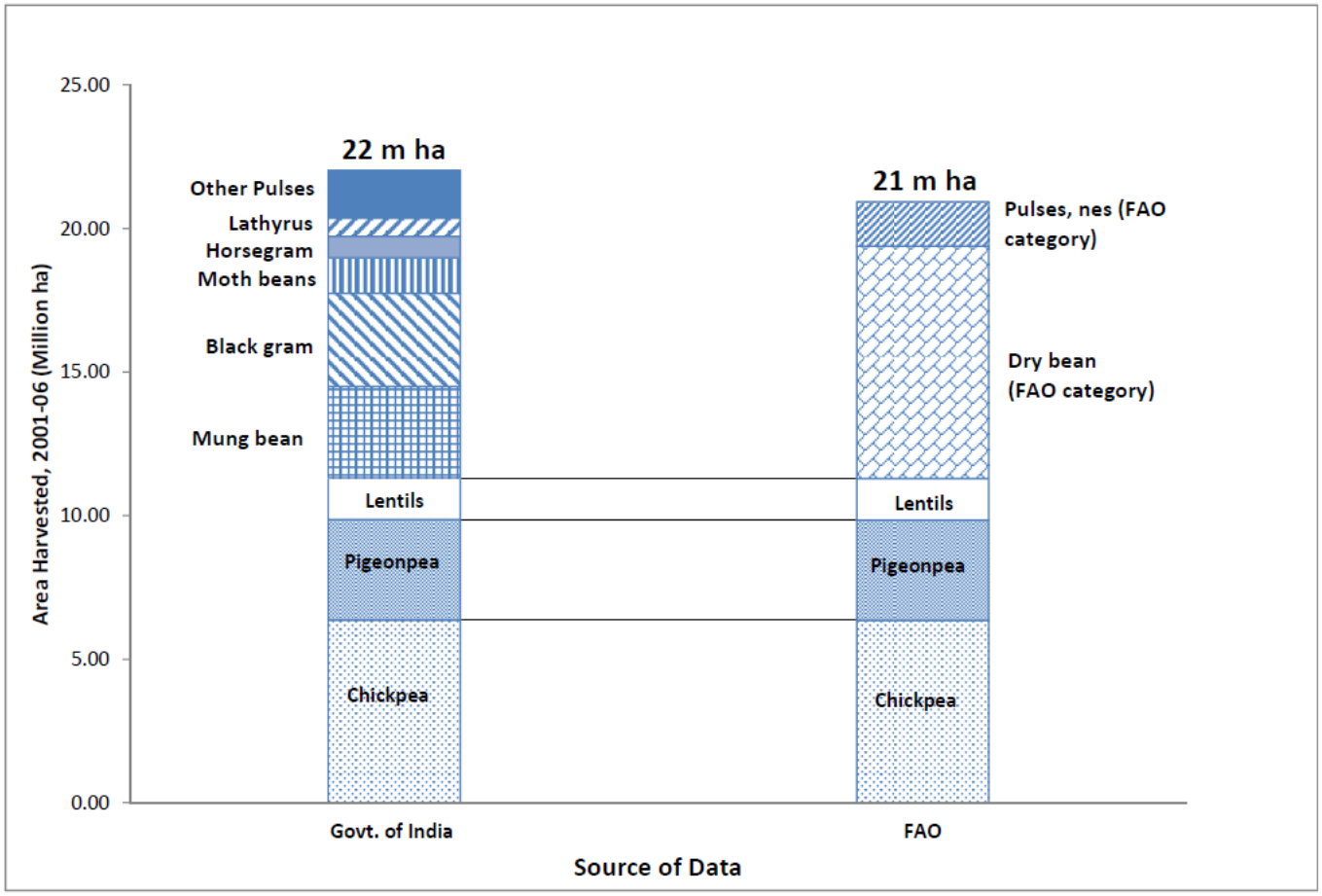
Annex 1
List of countries included in Regional Analysis (Regional composition is defined by FAO)

SSA	Angola	Côte d'Ivoire	Kenya	Niger	Swaziland
	Benin	D R Congo	Lesotho	Nigeria	Togo
	Botswana	Djibouti	Liberia	Réunion	Uganda
	Burkina Faso	Equatorial Guinea	Madagascar	Rwanda	United Republic of Tanzania
	Burundi	Eritrea	Malawi	Saint Helena	Zambia
	Cameroon	Ethiopia	Mali	Sao Tome and	Zimbabwe
	Cape Verde	Gabon	Mauritania	Senegal	
	Central African Republic	Gambia	Mauritius	Seychelles	
	Chad	Ghana	Mayotte	Sierra Leone	
	Comoros	Guinea	Mozambique	Somalia	
	Congo	Guinea-Bissau	Namibia	South Africa	
MENA	Algeria	Egypt	Kuwait	Oman	Tunisia
	Armenia	Georgia	Lebanon	Qatar	Turkey
	Azerbaijan	Iraq	Libyan Arab Jamahiriya	Saudi Arabia	United Arab Emirates
	Bahrain	Israel	Morocco	Sudan	Western Sahara
	Cyprus	Jordan	Occupied Palestinian	Syrian Arab Republic	Yemen
LAC	Anguilla	Cayman Islands	Guadeloupe	Mexico	Saint Kitts and Nevis
	Antigua and Barbuda	Chile	Guatemala	Montserrat	Saint Lucia
	Argentina	Colombia	Dominican Republic	Netherlands Antilles	Saint Vincent and the Grenadines
	Aruba	Costa Rica	Dominica	Nicaragua	Suriname
	Bahamas	Cuba	Guyana	Panama	Trinidad and Tobago
	Barbados	Ecuador	Haiti	Paraguay	Turks and Caicos Islands
	Belize	El Salvador	Honduras	Peru	United States Virgin Islands
	Bolivia	Falkland Islands	Jamaica	Puerto Rico	Uruguay
	Brazil	French Guiana	Martinique		Venezuela
	British Virgin Islands	Grenada			
C. Asia	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
E ASIA	China	Dem. Rep of Korea	Mongolia	Republic of Korea	
S ASIA	Afghanistan	Bhutan	Iran (Islamic Republic	Nepal	Sri Lanka
	Bangladesh	India	Maldives	Pakistan	
SE ASIA	Brunei Darussalam	Lao People's Democratic	Philippines	Viet Nam	
	Cambodia	Malaysia	Singapore	Timor-Leste	
	Indonesia	Myanmar	Thailand		
ROW	Albania	Faroe Islands	Kiribati	Norway	Svalbard and Jan Mayen Islands
	American Samoa	Fiji	Latvia	Palau	Sweden
	Andorra	Finland	Liechtenstein	Papua New Guinea	Switzerland
	Australia	France	Lithuania	Pitcairn Islands	The former Yugoslav Republic of Macedonia
	Austria	French Polynesia	Luxembourg	Poland	Tokelau
	Belarus	Germany	Malta	Portugal	Tonga
	Belgium	Gibraltar	Marshall Islands	Republic of Moldova	Tuvalu
	Bermuda	Greece	Micronesia	Romania	Ukraine
	Bosnia and	Greenland	Monaco	Russian Federation	United Kingdom
	Bulgaria	Guam	Montenegro	Saint Pierre and	United States of America
	Canada	Holy See	Nauru	Samoa	Vanuatu
	Channel Islands	Hungary	Netherlands	San Marino	Wallis and Futuna Islands
	Cook Islands	Iceland	New Caledonia	Serbia	
	Croatia	Ireland	New Zealand	Slovakia	
	Czech Republic	Isle of Man	Niue	Slovenia	
	Denmark	Italy	Norfolk Island	Solomon Islands	
	Estonia	Japan	Northern Mariana	Spain	

Annex 2
Average area harvested to different types of pulse crops in India, 2001-06: Comparison of data from Government of India and FAOSTAT



Source: For India: Directorate of Economics and Statistics, Ministry of Agriculture, New Delhi
For FAO: FAOSTAT (accessed December 2010)

Main points of the data presented in the figure are:

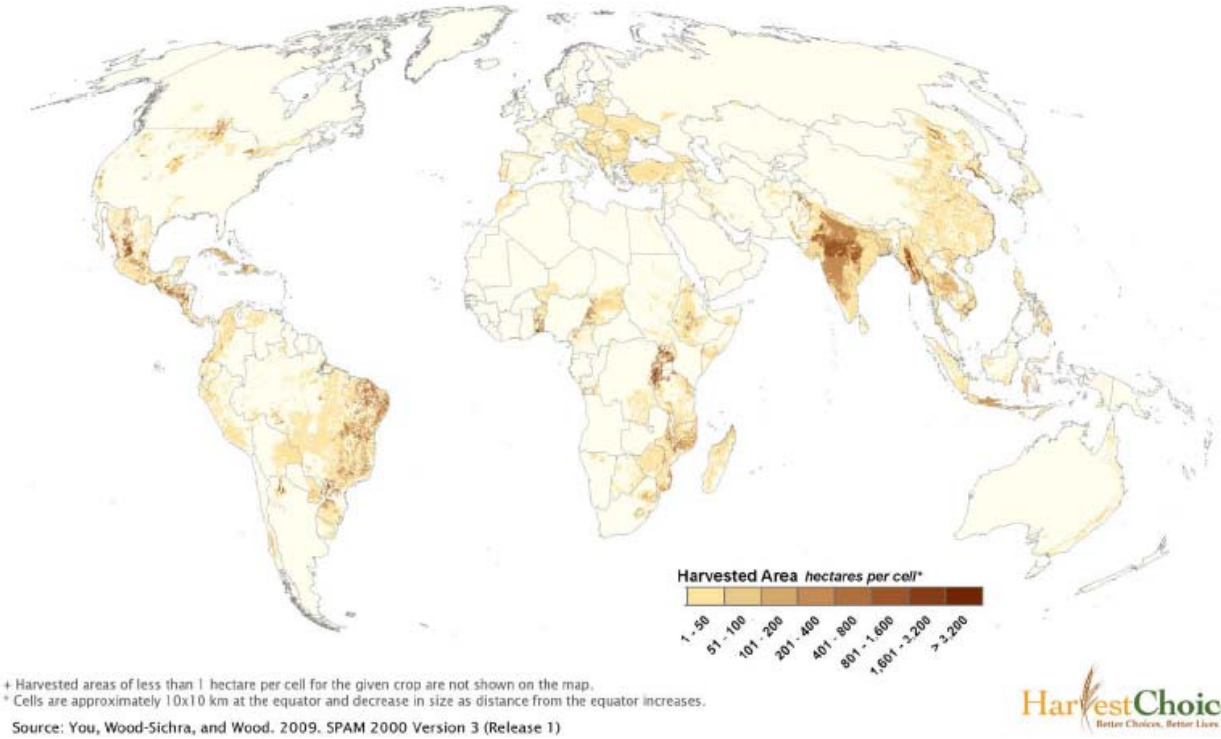
- The data for total area harvested is very consistent between the two sources. Assuming that the data from Government of India are more accurate, the FAO data underestimates total area under all Pulses by only about 1 m ha.
- There is an almost a 1:1 comparison in harvested area for chickpea, pigeon pea and Lentils data sourced from FAO and the Government of India.
- The figure reinforces the argument made in this paper that 'dry bean' is the most problematic category of pulse crop reported by FAO. There is no one-to-one correspondence with any specific pulse crop, which implies the following:
    - Dry bean does not necessarily equal to "common beans" around the world;
    - The aggregate global data for dry beans represent a group of three important pulse crops: common beans (*Ph. vulgaris*), mung beans (*Vigna radiata*) and black gram (*Vigna mungo*) and some other less important crops such as moth beans (*Vigna acontifolia*); the former are more important in LAC and SSA and the latter three are more important in Asia.

- It is implied from the figure above that the area under common beans (*Ph. vulgaris*) and cowpeas (*Vigna ungiculata*) along with some other minor pulse crops are included in "other pulses" under Govt. of India data. The total area harvested for "other pulses" is estimated to be 1.66 m ha in 2001-06. This means that each of these two crops (common beans and cowpea) are of relatively minor importance according to Indian crop production statistical standards and are not reported in a disaggregated manner like other major pulse commodities. Assuming that these two crops are included in the dry bean category reported by FAO, and taking into account the area harvested to black gram, mung beans and moth beans available from GOI, the author estimates that about 1.18 million ha of dry bean area is unaccounted by any crops. Attributing this area equally to common beans and cowpeas, the author's 'back of the envelope' estimate is that common beans and cowpeas may be harvested on about 0.5 million ha in India. If this is more or less accurate, then India could still be among the top 10 common bean and top five cowpea producing countries in the world.

Annex 3
Spatially Disaggregated Area and Yield Statistics for Dry Beans and Other Pulses

Figure A3.1: A global picture of where dry beans and other pulses are grown using spatially disaggregated production statistics of circa 2000 (Source: HarvestChoice)

Dry Beans Harvested Area

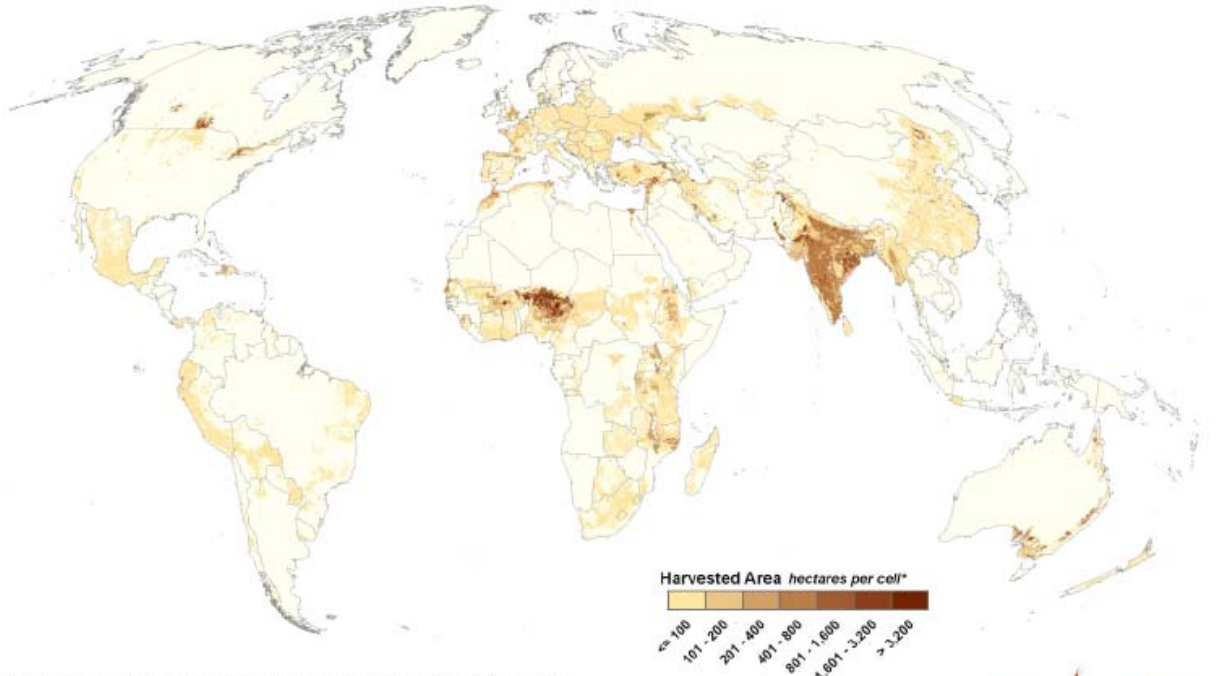


+ Harvested areas of less than 1 hectare per cell for the given crop are not shown on the map.
* Cells are approximately 10x10 km at the equator and decrease in size as distance from the equator increases.

Source: You, Wood-Sichra, and Wood. 2009. SPAM 2000 Version 3 (Release 1)

HarvestChoice
Better Choices, Better Lives

Other Pulses Harvested Area



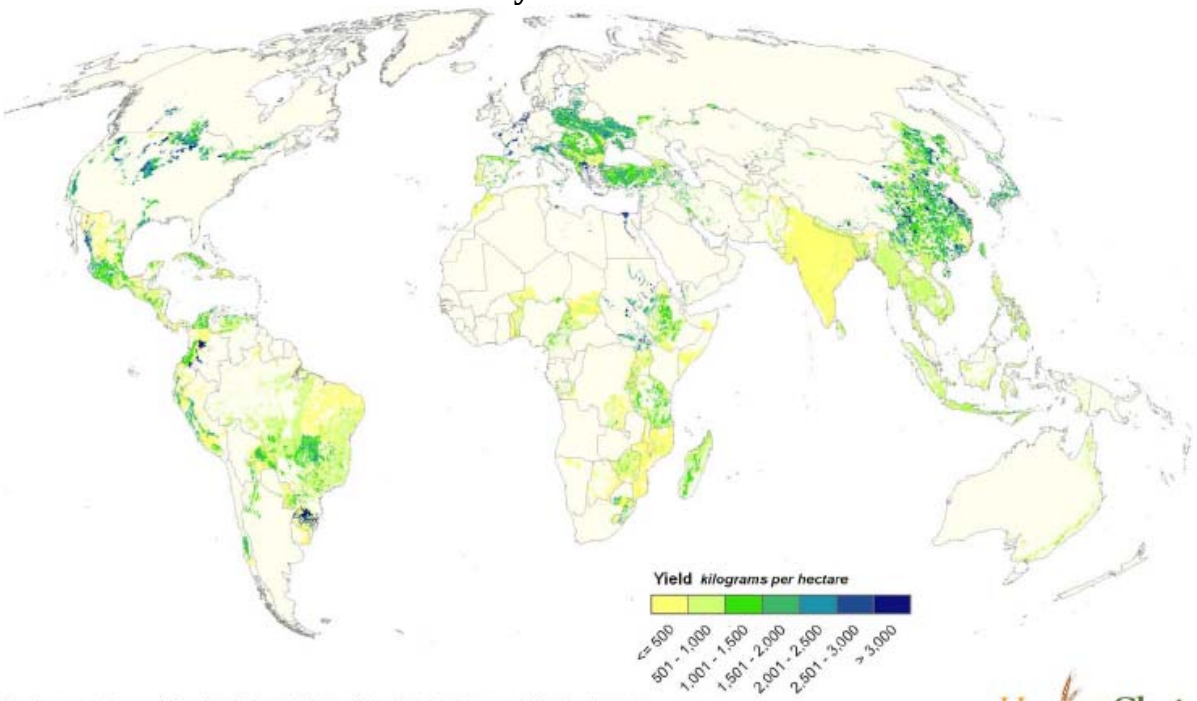
+ Harvested areas of less than 1 hectare per cell for the given crop are not shown on the map.
* Cells are approximately 10x10 km at the equator and decrease in size as distance from the equator increases.

Source: You, Wood-Sichra, and Wood. 2009. SPAM 2000 Version 3 (Release 1)

HarvestChoice
Better Choices, Better Lives

Figure A3.2: Yields of dry beans and other pulses using spatially disaggregated production statistics of circa 2000 (Source: HarvestChoice)

Dry Bean Yields



Yield values are not mapped for cells with harvested area of less than 1 hectare per cell for the given crop.

Source: You, Wood-Sichra, and Wood. 2009. SPAM 2000 Version 3 (Release 1)

HarvestChoice
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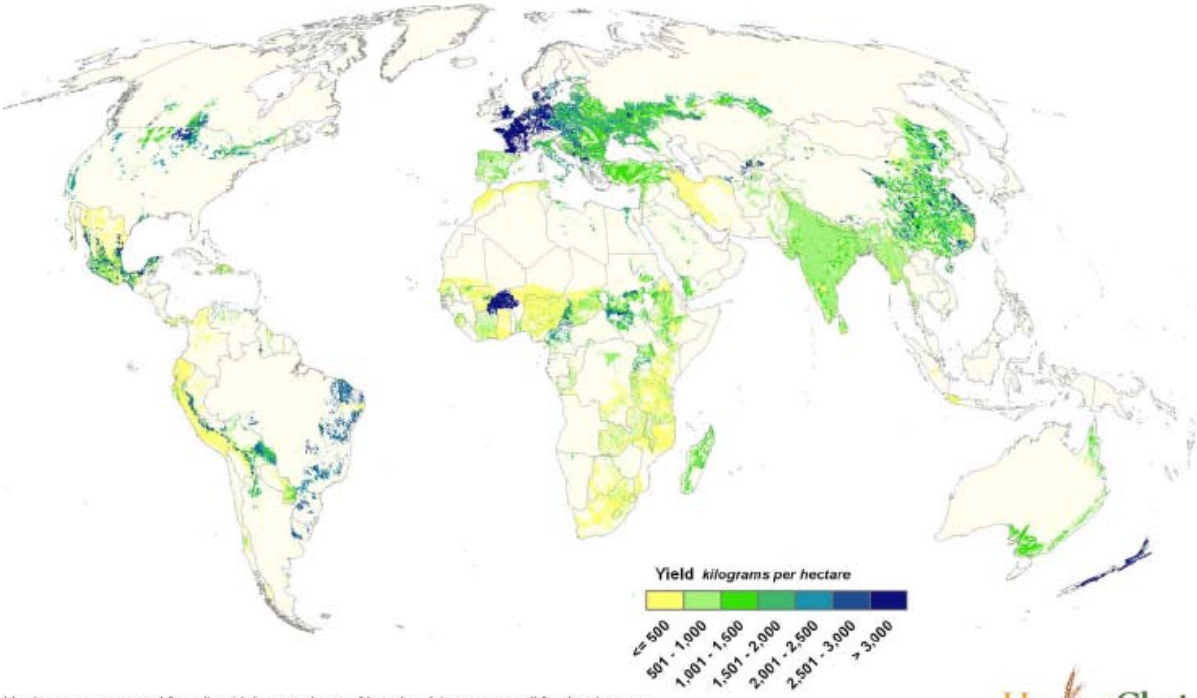
Other Pulses Yield



Yield values are not mapped for cells with harvested area of less than 1 hectare per cell for the given crop.

Source: You, Wood-Sichra, and Wood. 2009. SPAM 2000 Version 3 (Release 1)

HarvestChoice
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Annex 4
Tables on area, production and yield by crops and regions,[32] 1994-96 and 2006-08
Source: FAOSTAT (accessed December 2010)

Table A4.1: Dry beans

Dry beans	SSA	MENA	SEA	EA	SA	CA	LAC	ROW	WORLD
					Area Harvested (Million ha)				
1994-1996	3.54	0.77	2.93	0.82	8.72	--	8.33	1.35	26.48
2006-2008	5.69	0.67	3.79	0.69	9.31	--	6.93	1.08	28.19
Change in area	2.15	-0.10	0.85	-0.13	0.59	--	-1.40	-0.27	1.71
% Change	60.54	-12.79	29.15	-15.48	6.73		-16.83	-19.85	6.47
Growth rate (%/year)	4.02	-1.13	2.15	-1.39	0.54		-1.52	-1.83	0.52
					Production (Million Tons)				
1994-96	2.10	0.30	1.72	1.80	3.71	--	5.30	2.17	17.11
2006-08	3.50	0.31	3.18	1.91	3.86	--	5.91	1.95	20.69
Change in production	1.40	0.01	1.46	0.11	0.15	--	0.61	-0.22	3.58
% Change	66.34	3.43	84.92	5.86	4.09		11.51	-9.92	20.90
Growth rate (%/year)	4.33	0.28	5.26	0.48	0.33		0.91	-0.87	1.59
					Yield (Tons/ha)				
1994-96	0.59	0.39	0.59	2.20	0.43	--	0.64	1.61	0.65
2006-08	0.62	0.46	0.84	2.77	0.41	--	0.85	1.81	0.73
Change in yield	0.02	0.07	0.25	0.57	-0.01	--	0.22	0.20	0.09
% Change	3.61	18.76	42.93	26.10	-2.55		34.14	12.33	13.59
Growth rate (%/year)	0.30	1.44	3.02	1.95	-0.22		2.47	0.97	1.07

Table A4.2. Chickpea

	SSA	MENA	SEA	EA	SA	CA	LAC	ROW	WORLD
					Area Harvested (Million ha)				
1994-96	0.33	1.06	0.13	--	8.92	--	0.14	0.35	10.94
2006-08	0.39	0.74	0.22	--	8.94	--	0.11	0.51	10.92
Change in area	0.06	-0.32	0.09	--	0.01	--	-0.03	0.17	-0.02
% Change	18.22	-30.22	67.63	-	0.13	-	-21.56	47.98	-0.17
Growth rate (%/year)	1.40	-2.95	4.40	-	0.01	-	-2.00	3.32	-0.01
					Production (Million Tons)				
1994-96	0.19	0.91	0.08	--	6.43	--	0.21	0.29	8.11
2006-08	0.33	0.74	0.26	--	6.76	--	0.17	0.60	8.88
Change in production	0.14	-0.17	0.18	--	0.33	--	-0.04	0.31	0.77
% Change	75.60	-18.35	245.27	-	5.14	-	-19.68	108.49	9.49
Growth rate (%/year)	4.80	-1.68	10.88	-	0.42	-	-1.81	6.31	0.76
					Yield (Tons/ha)				
1994-96	0.56	0.86	0.62	--	0.72	--	1.50	0.83	0.74
2006-08	0.84	1.00	1.18	--	0.76	--	1.57	1.18	0.81
Change in yield	0.29	0.14	0.57	--	0.04	--	0.06	0.35	0.07
% Change	50.00	16.48	92.00	-	5.00	-	3.03	41.99	9.69
Growth rate (%/year)	3.50	1.26	5.59	-	0.41	-	0.25	2.96	0.77

[32] Only includes regions with at least 100,000 hectares of harvested area under a given crop.

Table A4.3. Cowpea

Cowpeas	SSA	MENA	SEA	EA	SA \a	CA	LAC \a	ROW	WORLD
					Area (Million ha)				
1994-96	8.10	--	0.06	--	0.02	--	0.05	0.01	8.24
2006-08	11.03	--	0.15	--	0.01	--	0.06	0.01	11.38
Change in area	2.93	--	0.09	--	-0.01	--	0.01	0.00	3.14
% Change	36.13	-	150.00	-	-50.00	-	20.00	0.00	38.09
Growth rate (%/year)	2.60	-	7.93	-	-5.61	-	1.53	0.00	2.73
					Production (Million Tons)				
1994-96	2.65	--	0.04	--	0.02	--	0.03	0.03	2.78
2006-08	4.93	--	0.15	--	0.01	--	0.06	0.03	5.23
Change in production	2.28	--	0.12	--	-0.01	--	0.03	0.00	2.45
% Change	85.79	-	275.00	-	-50.00	-	100.00	0.00	88.13
Growth rate (%/year)	5.30	-	11.64	-	-5.61	-	5.95	0.00	5.41
					Yield (Tons/ha)				
1994-96	0.33	--	0.67	-	1.00	-	0.60	3.00	0.34
2006-08	0.45	--	1.00	-	1.00	-	1.00	3.00	0.46
Change in yield	0.12	--	0.33	-	0.00	-	0.40	0.00	0.12
% Change	35.62	-	50.00	-	0.00	-	66.67	0.00	36.22
Growth rate (%/year)	2.63	-	3.44	-	0.00	-	4.35	0.00	2.61

\a Data for SA and LAC does not include India and Brazil, which explains the low estimates of area and production for these two regions. Data for these regions are included (despite the estimated area less than 100K) to point out the 'missing data' for two important cowpea producing countries.

Table A4.4. Pigeon pea

Pigeon peas	SSA	MENA	SEA	EA	SA	CA	LAC	ROW	WORLD
					Area (Million ha)				
1994-96	0.38	--	0.23	--	3.46	--	--	0.00	4.12
2006-08	0.51	--	0.54	--	3.65	--	--	0.00	4.73
Change in area	0.13	--	0.31	--	0.18	--	--	0.00	0.61
% Change	35.41	-	139.24	-	5.33	-	-	-	14.93
Growth rate (%/year)	2.56	-	7.54	-	0.43	-	-	-	1.17
					Production (Million Tons)				
1994-96	0.23	--	0.14	--	2.40	--	--	0.00	2.82
2006-08	0.39	--	0.60	--	2.73	--	--	0.00	3.75
Change in production	0.16	--	0.46	--	0.33	--	--	0.00	0.93
% Change	67.55	-	324.38	-	13.59	-	-	-	33.13
Growth rate (%/year)	4.39	-	12.80	-	1.07	-	-	-	2.41
					Yield (Tons/ha)				
1994-96	0.62	-	0.63	-	0.69	-	--	-	0.68
2006-08	0.77	-	1.12	-	0.75	-	--	-	0.79
Change in yield	0.15	-	0.49	-	0.05	-	--	-	0.11
% Change	23.71	-	77.26	-	7.85	-	-	-	15.81
Growth rate (%/year)	1.79	-	4.89	-	0.63	-	-	-	1.23

Table A4.5. Lentils

Lentils	SSA	MENA	SEA	EA	SA	CA	LAC	ROW	WORLD
					Area (Million ha)				
1994-96	0.08	0.84	--	0.10	1.87	--	--	0.47	3.41
2006-08	0.10	0.55	--	0.07	1.96	--	--	0.92	3.62
Change in area	0.03	-0.30	--	-0.03	0.08	--	--	0.45	0.21
% Change	35.02	-35.07		-29.30	4.45		-	95.89	6.19
Growth rate (%/year)	2.53	-3.53		-2.85	0.36		-	5.76	0.50
					Production (Million Tons)				
1994-96	0.04	0.84	--	0.11	1.19	--	--	0.57	2.80
2006-08	0.07	0.75	--	0.13	1.36	--	--	1.09	3.42
Change in production	0.03	-0.09	--	0.02	0.16	--	--	0.52	0.61
% Change	63.85	-10.71		17.40	13.68		-	90.85	21.88
Growth rate (%/year)	4.20	-0.94		1.35	1.07		-	5.53	1.66
					Yield (Tons/ha)				
1994-96	0.50	1.00	--	1.19	0.64	--	--	1.22	0.82
2006-08	0.70	1.36	--	2.03	0.69	--	--	1.18	0.94
Change in yield	0.20	0.36	--	0.84	0.06	--	--	-0.03	0.12
% Change	40.00	36.00		70.56	9.04			-2.31	15.06
Growth rate (%/year)	2.84	2.60		4.55	0.72			-0.19	1.18

Table A4.6: Faba beans

Faba beans	SSA	MENA	SEA	EA	SA	CA	LAC	ROW	WORLD
					Area (Million ha)				
1994-1996	0.34	0.46	--	1.05	--	--	0.18	0.30	2.34
2006-2008	0.47	0.45	--	0.93	--	--	0.19	0.42	2.46
Change in area	0.13	-0.01	--	-0.13	--	--	0.01	0.12	0.12
% Change	37.57	-1.32	-	-11.96	-	-	5.43	38.43	5.11
Growth rate (%/year)	2.69	-0.11	-	-1.06	-	-	0.44	2.75	0.42
					Production (Million Tons)				
1994-96	0.34	0.74	--	1.85	--	--	0.13	0.55	3.61
2006-08	0.62	0.72	--	1.72	--	--	0.19	0.86	4.12
Change in production	0.29	-0.02	--	-0.13	--	--	0.06	0.31	0.51
% Change	85.91	-3.10	-	-7.04	-	-	47.19	55.34	13.99
Growth rate (%/year)	5.30	-0.26	-	-0.61	-	-	3.27	3.74	1.10
					Yield (Tons/ha)				
1994-96	0.98	1.61	-	1.76	--	--	0.72	1.85	1.54
2006-08	1.32	1.60	-	1.85	--	--	1.00	2.05	1.67
Change in yield	0.35	-0.01	-	0.09	--	--	0.28	0.21	0.13
% Change	34.61	-0.54	-	4.97	-	-	38.46	11.69	8.56
Growth rate (%/year)	2.51	-0.05	-	0.40	-	-	2.75	0.93	0.69

Table A4.7. Soybean in West Africa

Soybean West Africa	1994-06	2006-08	Change	% Change	Growth rate (%/year)
Area (Million ha)	0.58	0.67	0.08	15.52	1.21
Production (Million Tons)	0.27	0.62	0.35	129.63	7.17
Yield (Tons/Ha)	0.47	0.93	0.46	98.78	5.89

Annex 5
Producer Price by Top Pulse Growing Countries, 1994 to 2008

Table A5.1. Dry bean producer price in top 20 developing countries ranked by area harvested, 1994-2008

		Year															% change in producer price	
Country	Rank	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	1994-1999	2000-2008
India	1	353	371	295	261	282	299	327	289	300	324	342	364	357	414	429	-15%	31%
Brazil	2	690	543	609	558	899	415	337	404	393	440	395	538	547	671	1300	-40%	286%
Myanmar	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Mexico	4	563	341	561	691	661	550	553	669	593	471	508	634	578	639	823	-2%	49%
Tanzania	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
China	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Uganda	7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Kenya	8	304	359	388	427	408	367	456	394	347	415	441	489	571	560	555	21%	22%
Rwanda	9	430	462	323	634	542	305	252	226	206	185	184	194	213	226	261	-29%	4%
Angola	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Republic of Korea	11	3201	3881	3383	3092	1970	2492	2906	2115	2043	2999	2884	2635	2466	2480	1851	-22%	-36%
Indonesia	12	163	209	215	192	94	140	118	115	136	148	151	152	183	211	223	-14%	89%
Cameroon	13	337	561	391	336	424	487	399	426	448	595	682	708	745	834	909	45%	128%
Pakistan	14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Malawi	15	115	85	1015	919	791	164	636	635	624	695	726	739	759	870	999	43%	57%
Argentina	16	631	770	1221	713	600	730	901	790	431	534	619	724	778	921	1083	16%	20%
Nicaragua	17	327	1054	938	903	856	724	622	528	471	387	533	550	503	502	526	121%	-15%
Burundi	18	594	312	396	647	603	585	513	373	367	346	468	491	575	804	884	-1%	72%
Congo	19	630	701	684	600	780	686	578	526	638	734	843	885	1028	1104	1263	9%	118%
Ethiopia	20	284	287	246	227	216	219	209	148	120	191	210	213	229	257	303	-23%	45%
Average		616	710	762	729	652	583	629	546	508	605	642	665	681	749	815	-5%	30%

NA=Not available

Table A5.2. Chickpea producer price in top 20 developing countries ranked by area harvested, 1994-2008

		Year															% change in producer price	
	Rank	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	1994-1999	2000-2008
India	1	323	318	333	358	356	351	357	354	343	350	382	389	478	358	341	9%	-5%
Pakistan	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Iran	3	572	1505	666	523	951	2150	2832	1414	317	281	352	467	748	681	733	276%	-74%
Turkey	4	459	847	563	442	485	558	673	477	560	642	738	797	786	963	1146	21%	70%
Myanmar	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Ethiopia	6	262	304	246	216	231	217	223	164	148	196	215	230	253	456	523	-17%	135%
Mexico	7	480	456	547	493	435	369	511	495	405	376	644	653	649	729	700	-23%	37%
Malawi	8	104	77	913	1004	640	149	415	396	499	493	506	475	467	522	559	43%	35%
Syria	9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Morocco	10	782	1240	1004	463	425	514	703	686	363	338	552	775	895	910	910	-34%	29%
Tanzania	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Yemen	12	1700	789	680	503	478	533	538	534	528	539	541	697	756	838	989	-69%	84%
Algeria	13	542	955	822	780	766	676	598	583	472	493	544	562	618	685	767	25%	28%
Bangladesh	14	407	420	399	388	382	367	359	319	306	310	370	389	381	411	460	-10%	28%
Tunisia	15	1186	1290	1181	1067	1098	1096	985	973	1020	1164	1205	1196	1142	1195	1170	-8%	19%
Iraq	16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Nepal	17	377	365	394	400	469	453	457	454	443	457	497	533	561	738	760	20%	66%
Eritrea	18	307	368	428	360	606	752	580	501	479	525	610	588	674	732	842	145%	45%
Sudan	19	219	390	275	231	278	289	264	207	165	575	667	793	948		1218	32%	361%
Kazakhstan	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Average		552	666	604	516	543	605	678	540	432	481	559	610	668	709	794	10%	17%

NA=Not available

Table A5.3. Cowpea producer price in top 15 developing countries ranked by area harvested, 1994-2008

		Year															% change in producer price	
	Rank	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	1994-1999	2000-2008
Niger	1																	
Nigeria	2	968	1245	2065	1842	1804	472	451	515	494	451	519	745	677	609	697	-51%	55%
Burkina Faso	3	180	200	274	244	293	232	212	270	323	267	302	296	306	329	369	29%	74%
Mali	4	162	245	213	195	193	199	173	168	194	233	256	257	258	304	355	23%	106%
Senegal	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Myanmar	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Tanzania	7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Kenya	8	162	191	207	227	217	195	242	226	247	263	351	294	393	479	498	21%	105%
Congo	9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Sudan	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Cameroon	11	288	341	284	257	339	520	425	310	326	365	383	392	413	447	487	80%	14%
Malawi	12	69	79	783	665	574	151	452	479	428	535	549	515	507	578	637	120%	41%
Uganda	13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Haiti	14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Mauritania	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Peru	16	414	387	393	450	481	334	264	277	273	285	240	328	391	461	489	-19%	86%
South Africa	17	315	415	305	231	265	240	223	205	212	303	297	267	358	416	424	-24%	90%
Sri Lanka	18	340	392	459	436	373	373	375	431	383	387	379	419	500	684	790	9%	111%
Guinea-Bissau	19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Philippines	20	NA	NA	NA	NA	NA	NA	NA	699	243	226	271	299	409	373	412		
Average		322	388	554	505	504	302	313	358	312	332	355	381	421	468	516	-6%	65%

NA=Not available

Table A5.5. Lentil producer price in top 10 developing countries ranked by area harvested, 1994-2008

		Year															% change in producer price	
	Rank	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	1994-1999	2000-2008
India	1	312	384	357	332	311	323	305	286	278	293	337	348	341	398	393	3%	29%
Turkey	2	388	663	506	444	529	557	609	425	516	628	711	923	702	813	1265	44%	108%
Iran	3	626	1093	796	956	1448	2517	2194	1384	387	285	404	466	582	678	1084	302%	-51%
Nepal	4	244	236	255	259	303	293	295	294	475	398	584	627	660	788	845	20%	186%
Syria	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Bangladesh	6	383	418	483	465	394	410	401	373	362	430	471	544	534	586	666	7%	66%
Ethiopia	7	390	388	381	349	353	331	299	208	191	267	350	401	206	577	772	-15%	158%
China	8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Morocco	9	874	836	585	431	508	616	783	500	372	395	486	714	486	720	1139	-29%	46%
Pakistan	10	173	277	338	257	205	163	158	158	406	456	458	452	487	556	509	-6%	223%
Yemen	11	2482	1224	680	503	478	533	538	534	528	539	541	697	756	838	964	-79%	79%
Mexico	12	325	311	525	299	309	275	332	265	162	239	240	277	400	281	448	-15%	35%
Iraq	13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Colombia	14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Peru	15	513	481	487	589	536	426	438	456	469	463	496	574	581	601	790	-17%	80%
Average		610	574	490	444	489	586	578	444	377	399	462	548	521	621	807	-4%	40%

NA=Not available

Table A5.4. Pigeon pea producer price in top 10 developing countries ranked by area harvested, 1994-2008

		Year															% change in producer price	
	Rank	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	1994-1999	2000-2008
India	1	401	475	365	386	451	386	338	364	367	391	404	435	484	345	317	-4%	-6%
Myanmar	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Kenya	3	277	327	354	390	372	335	416	339	367	410	421	412	417	496	514	21%	24%
Malawi	4	74	65	727	545	531	126	418	408	351	570	440	496	481	551	604	69%	45%
Uganda	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Tanzania	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Dominican Republic	7	685	556	601	635	581	590	463	568	581	411	424	686	665	688	728	-14%	57%
Nepal	8	244	236	717	259	303	293	295	294	475	398	712	773	782	953	1,058	20%	258%
Congo	9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Haiti	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Average		336	332	553	443	448	346	386	395	428	436	480	561	566	607	644	3%	67%

NA=Not available

Table A5.6. Faba bean producer price in top 19 developing countries ranked by area harvested, 1994-2008

		Year															% change in producer price	
	Rank	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	1994-1999	2000-2008
China	1	132	218	282	248	296	232	273	286	322	344	370	389	416	481	587	75%	115%
Ethiopia	2	218	221	189	174	167	169	161	153	128	195	214	220	237	333	360	-23%	124%
Morocco	3	464	556	422	366	421	421	485	406	375	345	371	383	357	479	653	-9%	35%
Egypt	4	293	300	328	358	364	369	361	315	283	241	342	372	391	405	693	26%	92%
Sudan	5	491	873	616	517	622	648	592	463	370	532	580	669	804		928	32%	57%
Tunisia	6	386	407	380	344	351	354	321	313	324	365	378	371	368	390	547	-8%	70%
Peru	7	346	333	351	319	338	296	304	302	287	282	264	307	327	365	431	-15%	42%
Brazil	8	555	439	446	494	583	460	523	364	280	282	254	346	352	408	792	-17%	51%
Algeria	9	368	483	457	433	426	376	332	291	236	242	262	271	298	329	369	2%	11%
Guatemala	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Mexico	11	614	513	704	684	617	606	590	417	430	449	443	615	613	665	682	-1%	16%
Syria	12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Paraguay	13	439	606	501	446	511	508	422	254	219	305	332	417	313	385	437	16%	4%
Ecuador	14	32	53	61	101	138	218	340	408	520	421	583	845	551	271	427	583%	25%
Bolivia	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Turkey	16	216	282	351	298	297	292	393	291	328	418	504	521	611	686	769	35%	96%
Dominican Republic	17	1462	1270	1196	1301	1008	836	810	833	912	609	608	895	654	703	752	-43%	-7%
Nepal	18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Israel	19	504	553	574	598	599	549	662	547	549	549	625	636	674	956	1233	9%	86%
Average		435	474	457	446	449	422	438	376	371	372	409	484	464	490	644	-3%	47%

NA=Not available

Annex 6
Volume and Value of Pulse Crop Imports and Exports by Top Countries in the World, 2008
(Source: FAO/TradeSTAT)

Dry Bean Importing Countries, 2008

Rank	Area	Quantity (ton)	Value (1000 $)	Unit value ($/ton)
1	India	604518	399271	660
2	Brazil	209690	211648	1009
3	USA	166783	168790	1012
4	Italy	109875	134622	1225
5	United Kingdom	148055	128450	868
6	Japan	119113	127805	1073
7	Mexico	95038	92994	978
8	Spain	56899	81011	1424
9	Venezuela	59954	69324	1156
10	France	50828	65228	1283
11	Algeria	53520	59258	1107
12	Turkey	51462	56269	1093
13	China	103602	55590	537
14	Cuba	70869	54890	775
15	Costa Rica	53076	54762	1032
16	Angola	53290	54025	1014
17	Canada	52397	51686	986
18	Portugal	43141	46176	1070
19	South Africa	70040	44565	636
20	United Arab Emirates	47903	38919	812

Dry Bean Exporting Countries, 2008

Rank	Area	Quantity (ton)	Value (1000 $)	Unit value ($/ton)
1	China	959823	778265	811
2	Myanmar	675000	415400	615
3	USA	415321	343287	827
4	Argentina	229199	264598	1154
5	Canada	293595	256901	875
6	Nicaragua	54641	75536	1382
7	Colombia	41887	55690	1330
8	Ethiopia	74389	49651	667
9	Netherlands	18620	44502	2390
10	Bolivia	34422	41648	1210
11	Thailand	51227	40305	787
12	Peru	35078	36675	1046
13	Mexico	22944	30361	1323
14	United Kingdom	61375	27276	444
15	Egypt	37882	26163	691
16	Belgium	23802	24288	1020
17	United Arab Emirates	25983	20881	804
18	Kyrgyzstan	33471	19949	596
19	Australia	21733	18132	834
20	Portugal	11436	15701	1373

Faba Bean Importing Countries, 2008

Rank	Area	Quantity (ton)	Value (1000 $)	Unit value ($/ton)
1	Egypt	277875	154264	555
2	Sudan	45652	30720	673
3	Italy	54570	26930	493
4	Saudi Arabia	33702	23742	704
5	United Arab Emirates	16707	12783	765
6	Spain	22552	10733	476
7	Jordan	10523	7391	702
8	Japan	6223	5814	934
9	Indonesia	8785	5260	599
10	Yemen	9397	5004	533
11	Palestinian Territory	9570	5000	522
12	Lebanon	7300	4928	675
13	France	6003	3847	641
14	USA	2515	3101	1233
15	China	3456	2883	834
16	Ethiopia	4426	2720	615
17	Thailand	3891	2275	585
18	Algeria	1854	1886	1017
19	Kuwait	2579	1849	717
20	Greece	1924	1674	870

Faba Bean Exporting Countries, 2008

Rank	Area	Quantity (ton)	Value (1000 $)	Unit value ($/ton)
1	France	199292	95729	480
2	Australia	93503	58842	629
3	United Kingdom	89114	42845	481
4	Ethiopia	47144	28552	606
5	China	43861	27477	626
6	Belgium	20805	10065	484
7	Egypt	7406	5755	777
8	Spain	2612	4313	1651
9	Morocco	1570	2060	1312
10	Canada	3202	1933	604
11	Turkey	1942	1581	814
12	Peru	1280	1565	1223
13	USA	5735	1436	250
14	Netherlands	624	1227	1966
15	Germany	1962	1107	564
16	Bolivia	899	966	1075
17	Mexico	711	874	1229
18	Italy	862	783	908
19	Lebanon	586	484	826
20	Tunisia	2224	479	

Chickpea Importing Countries, 2008

Rank	Area	Quantity (ton)	Value (1000 $)	Unit value ($/ton)
1	India	198215	108186	546
2	Pakistan	114682	69702	608
3	Spain	54377	64044	1178
4	United Arab Emirates	75249	53300	708
5	Bangladesh	79216	50039	632
6	Algeria	40519	43146	1065
7	United Kingdom	32610	32370	993
8	Saudi Arabia	47074	27304	580
9	Italy	23410	24281	1037
10	Jordan	26397	21255	805
11	Iran (Islamic Republic of)	24126	20891	866
12	United States of America	19503	20204	1036
13	Egypt	21890	19177	876
14	Sri Lanka	17153	17265	1007
15	Iraq	14643	13515	923
16	Norway	32024	13375	418
17	Portugal	11878	12243	1031
18	Lebanon	10977	10598	965
19	Colombia	12763	9363	734
20	Turkey	8760	9154	1045

Chickpea Exporting Countries, 2008

Rank	Area	Quantity (ton)	Value (1000 $)	Unit value ($/ton)
1	Australia	271548	145450	536
2	India	127101	116289	915
3	Mexico	108802	115506	1062
4	Turkey	88338	76758	869
5	Myanmar	82000	49900	609
6	Canada	57879	45520	786
7	Ethiopia	41472	28024	676
8	United Arab Emirates	30998	20982	677
9	United States of America	20389	16417	805
10	Russian Federation	29974	11406	381
11	Argentina	8155	7333	899
12	Tanzania	15670	6361	406
13	Portugal	3949	5927	1501
14	Kazakhstan	1133	5647	4984
15	Spain	3168	4054	1280
16	Italy	3480	2787	801
17	United Kingdom	1272	2571	2021
18	Netherlands	1312	2338	1782
19	Malawi	3405	2184	641
20	Belgium	1930	1845	956

Lentil Importing Countries, 2008

Rank	Area	Quantity (ton)	Value (1000 $)	Unit value ($/ton)
1	Turkey	191683	243967	1273
2	Sri Lanka	102710	108353	1055
3	United Arab Emirates	82537	81202	984
4	Egypt	66364	73964	1115
5	Algeria	65000	60627	933
6	Spain	48175	48149	999
7	Iran	38387	41424	1079
8	Sudan	37770	41023	1086
9	United Kingdom	20870	35832	1717
10	Colombia	56061	35211	628
11	Pakistan	70019	33680	481
12	India	33210	32872	990
13	Bangladesh	38960	32106	824
14	Saudi Arabia	29675	31270	1054
15	Italy	27132	29695	1094
16	France	31086	28925	930
17	Mexico	32645	27417	840
18	United States of America	24094	27158	1127
19	Germany	21891	25920	1184
20	Morocco	24702	21215	859

Lentil Exporting Countries, 2008

Rank	Area	Quantity (ton)	Value (1000 $)	Unit value ($/ton)
1	Canada	852876	797957	936
2	United States of America	168646	114351	678
3	Turkey	70340	101249	1439
4	Australia	76026	72241	950
5	United Arab Emirates	36612	33462	914
6	Nepal	16417	22075	1345
7	Egypt	16049	17293	1078
8	China	17965	13417	747
9	Sri Lanka	7212	12427	1723
10	Ethiopia	10799	8601	796
11	Belgium	8675	8103	934
12	Netherlands	5381	6756	1256
13	Spain	5326	5381	1010
14	France	2276	4547	1998
15	United Kingdom	1686	4171	2474
16	Germany	1687	3557	2108
17	Portugal	3451	3551	1029
18	Syrian Arab Republic	3337	2729	818
19	Thailand	1924	1924	1000
20	Italy	1157	1659	1434

Cowpea Importing Country, 2008

Rank	Area	Quantity (ton)	Value (1000 $)	Unit value ($/ton)
1	United States of America	1562	961	615

Cowpea Exporting Country, 2008

Rank	Area	Quantity (ton)	Value (1000 $)	Unit value ($/ton)
1	United States of America	982	805	820

Pigeon Pea Importing Countries, 2008

Rank	Area	Quantity (ton)	Value (1000 $)	Unit value ($/ton)
1	Mauritius	1490	1491	1001
2	Trinidad and Tobago	1	10	10000

Pigeon Pea Exporting Countries, 2008

Rank	Area	Quantity (ton)	Value (1000 $)	Unit value ($/ton)
1	Myanmar	1000	862	862
2	Dominican Republic	70	58	829
3	Mauritius	22	22	1000

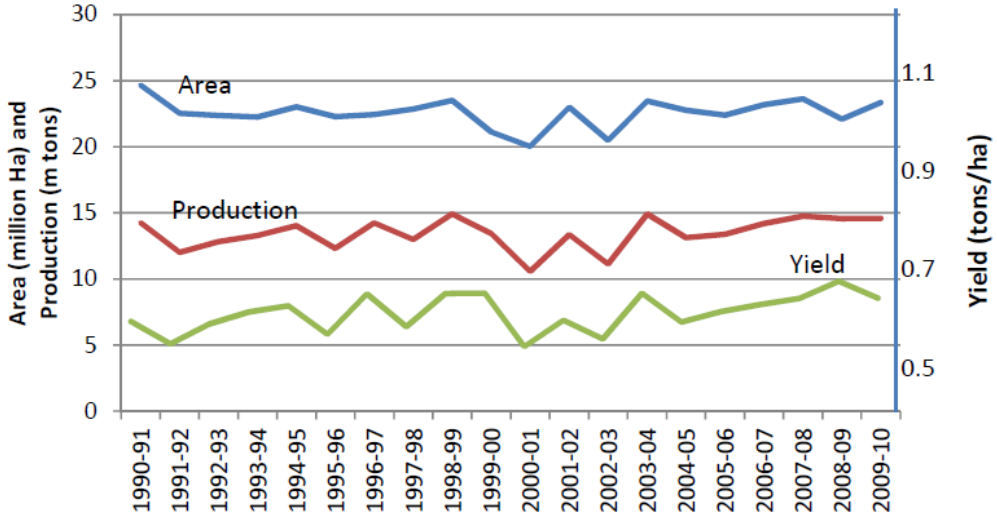
Annex 7

Patterns and Trends in Pulse Consumption: The Case of India

Figure A7.1 provides the total pulse area, production and yield data for India over the past 20 years, which shows pulse area and production have been basically stagnant. Since mid-1990s, pulse area, production and yield have exhibited only a marginal upward trend but with wide year-to-year fluctuations. This marginal increase comes after a steady decline in pulse area and production in the 1960s to 1980s following the introduction of high yielding wheat and rice varieties, which shifted production of some pulse crops (i.e., chickpeas) to these HYV cereal crops, particularly in irrigated areas. Overall, area under pulse crops increased at an average annual rate of 0.15% (or 36 thousand ha per year), production increased at a rate of 0.61% (or 93 thousand tons per year), and yield increased at a rate of 0.5% (or 3.14 kg/year) (Figure BB). This rate of increase in production was less than the growth rate in population. As a result, the per capita production of pulse crops continued a downward trend observed in previous decades and declined from 14 kg in mid 1990s to 12 kg in 2008, with the level reaching almost 10 kg in 2000. Recognizing the need to increase productivity and profitability of pulse crops, the government of India has taken steps (e.g., raising the minimum support prices) and instituted several programs, such as the "accelerated pulses production programme (A3P)" which was recently launched under the aegis of the National Food Security Mission (Ministry of Agriculture and Cooperation, 2010). Whether these programs will have a positive effect in attracting more area under pulses remains to be seen.

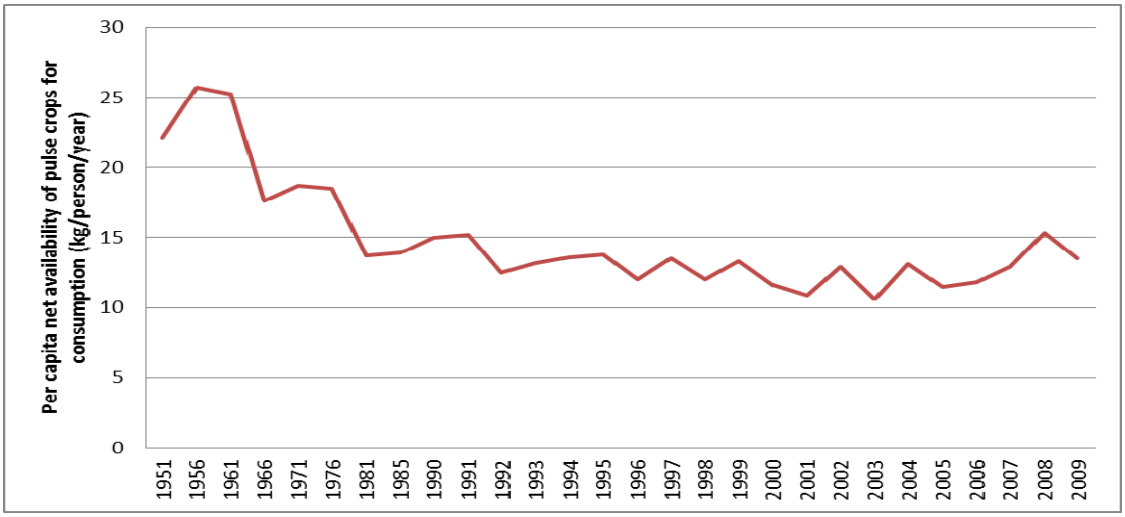
Meanwhile, the declining per capita production has been compensated by increasing imports of pulse crops. Since 1999-2000, import policies for pulses have been increasingly liberalized. As a result, in recent years (2006-08), imports of pulses, net of exports have been in the order of 2-3 million tons per year or about 15-20% of total production (up from 3% of total production in early 1990s). The liberalization of pulse market has had some impact in stabilizing the price of pulse crops as the price of pulses grew much slower in the period after 2000 than it did in the nineties (Swamy 2010). However, even with liberalization the price of pulses continued to rise faster than that of cereals, eggs, meat and fish in the years 2000 to 2010 (Swamy 2010).

Figure A7.1: Area, production and yield of pulse crops in India, 1990-2009



As a result of the surging population, stagnating pulse production, and rising pulse prices (relative to other commodities), per capita availability of pulses for consumption has continued the declining trend observed since1950s (Figure A7.2). After exhibiting a dramatic decline in the 1960s, 1970s and 1980s, the rate of decline in per capita availability of pulses has slowed down in the last 20 years, and especially since 2000. In fact, in the last three years for which data are available, there has been a steady upward trend in per capita availability of pulses (Figure A7.2).

Figure A7.2: Per capita net availability of pulses for consumption in India, 1951-2007



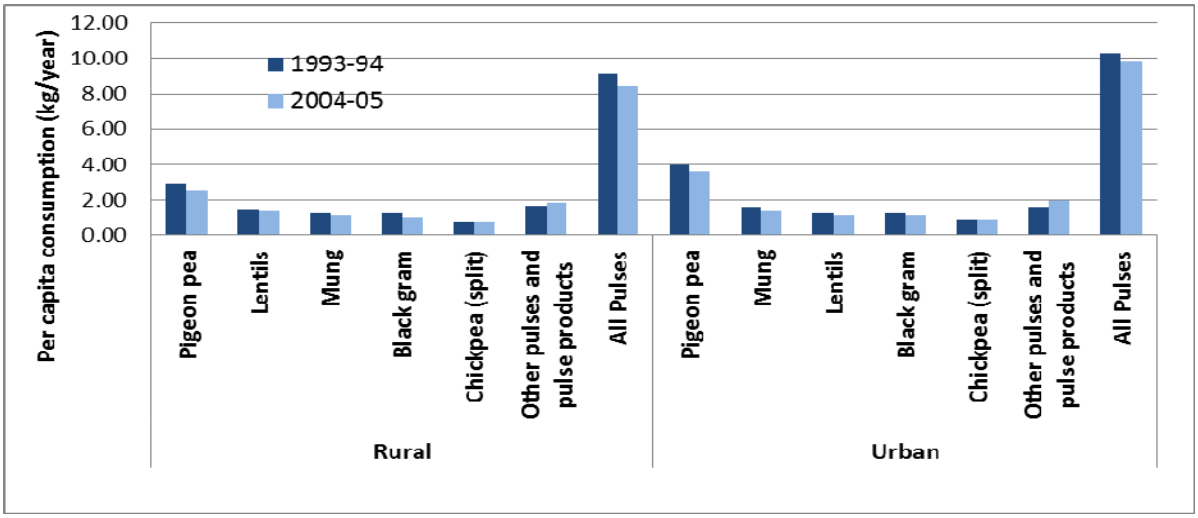
Source: Government of India, Agricultural Statistics At a Glance, 2010

The declining per capita availability of pulses over the years has translated into a decline in per capita consumption of pulse crops since 1950s. We focus our analysis on the consumption trend and patterns in India in the last 15 years. Comprehensive data on quantity of different types of food consumed is collected by the National Sample Survey Organization every five years. The last round of this nationally representative survey was conducted in 2010 and correspond to the year 2009-2010. However, results of this survey are yet to be released. Hence the data available for quantity of food consumed that roughly covers the period since mid-1990s are for 1993-94, 1999-00 and 2004-05. However, as reported in NSSO Report 509, the data on per capita consumption for some food items such as pulses and fruits & vegetables collected in 1999-00 were not comparable with data in 1993-94 and 2004-05 due to some methodological issues related to the reference period (NSSO 2008, page 14). Hence we are left with consumption data to compare for only two time periods—1993-94 and 2004-05. Expenditure data on food consumption are collected by NSSO on a regular basis and the latest year of data available is 2007-08. Similarly, data on quantity of per capita consumption on cereals and chickpea (split gram) are reported by NSSO more regularly and the last year for such data is 2007-08. In the analysis presented below, we use these various data collected by NSSO in their annual and quinquennial rounds of household surveys.

Figure A7.3 presents the per capita consumption (kg/year) of major pulses in rural and urban India and change in consumption from mid-1990s to mid-2000s. The average per capita consumption of all pulses in 2004-05 was estimated at 8.5 kg/year in rural areas and 9.9 kg/year in urban areas. Per capita consumption of pulse crops has declined across most types and among both rural and urban population

from 1993 to 2004. The only exception to this trend is 'other pulses and pulse products,'[33] whose consumption increased from 1.7 kg/person/year to 1.9 kg in rural areas and from 1.6 kg /person/year to 2 kg in urban areas. Overall, the per capita consumption of pulse crops fell by 7% in rural areas and 4% in urban areas, with the biggest drop seen in the consumption of black gram in rural parts (-20%) and mung beans (-15%) in urban India.

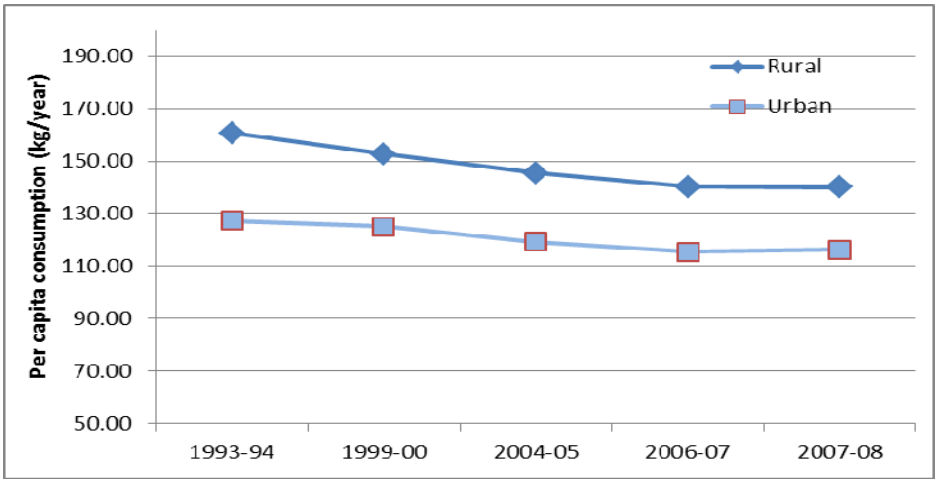
Figure A7.3: Change in per capita consumption of different pulse crops, 1993-94 to 2004-05



Source: NSSO Report #509

The per capita consumption of cereal crops in the same time period has also dropped more steeply by 11% and 7% in rural and urban areas, respectively (Figure A7.4). This declining trend in the consumption of cereal crops has continued beyond 2004 reaching 140 kg/person/year in rural areas and 116 kg/person/year in urban areas (Figure A7.4).

Figure A7.4: Per capita cereal consumption in rural and urban India, 1993-2008

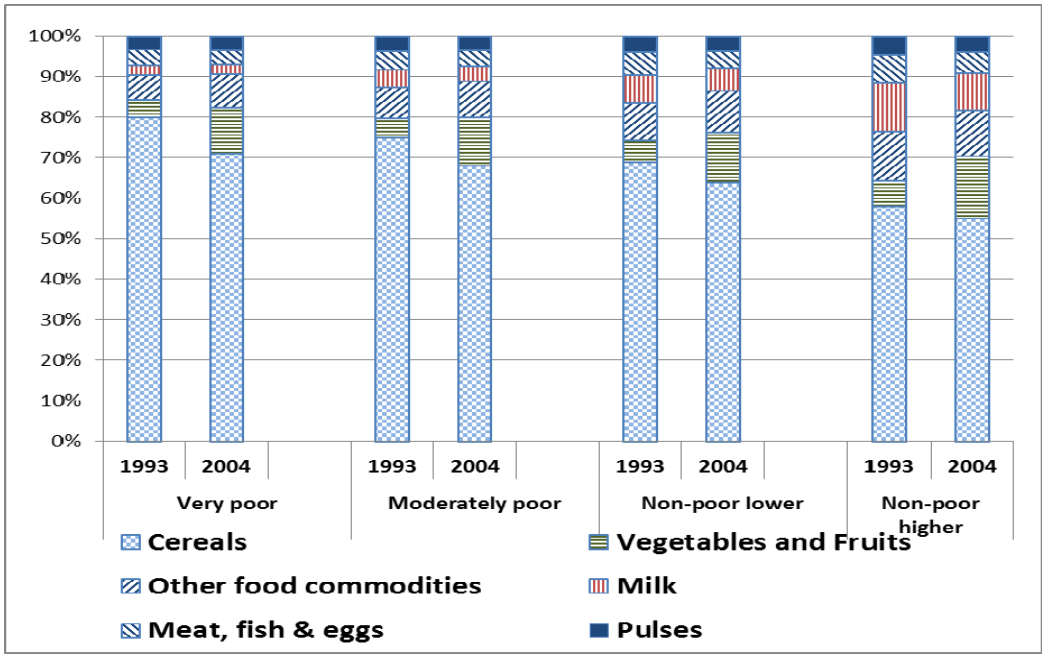


Source: NSSO reports 509, 514, 523, 527, 530

[33] This includes other pulse grains not included in the graph (e.g., moth beans, cowpeas, rajma beans, lathyrus, horsegram, etc.) as well as processed products such as 'besan' (chickpea flour).

The declining per capita consumption of cereal and pulses implies that the share of these foods in total calories consumed by an average Indian must have also declined from 1993 to 2004.[34] The sharp decline in the importance of cereals as a source of calories in Indian diets over this time period is evident from Figure A7.5. For pulses, the share in total calories consumed has declined by 10% and 13% respectively for non-poor lower and non-poor higher income groups, but for 'moderately poor', it has only declined modestly, and for the 'very poor' the caloric contribution of pulses has infact increased by 6% from 1993 to 2004. Thus, the results for pulses are mixed and not as clear-cut across all income groups as they are for cereals. Even though, pulses are consumed widely in India, they contribute a very small percentage of total calories consumed by an average Indian. The share of pulses in total calorie consumption in 2004 ranged from 3.4% for the 'very poor' to 4% for 'non-poor higher' income groups. In both the years, the share of pulses in total calories consumed increased with the level of income. This positive correlation between pulse' contribution to total calories consumed and level of income is opposite of the correlation between cereals' contribution to total calories and income level. In fact, all other categories of food show a positive correlation with income, except cereal crops (Figure A7.5).

Figure A7.5: Share of different categories of food in total calorie consumption in India, by income groups, 1993 and 2004 \a



Source: Kumar 2010

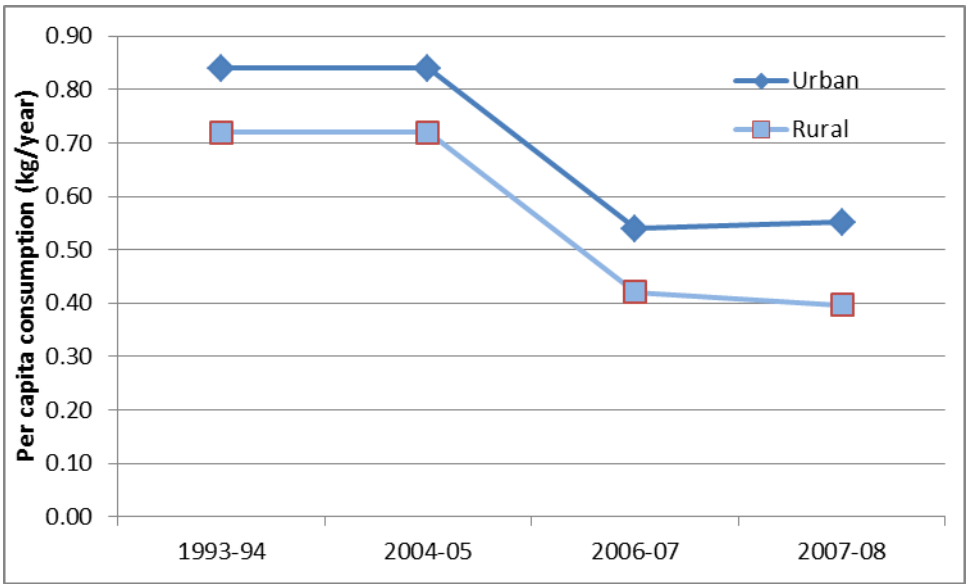
\a Income groups are defined based on household expenditure relative to the poverty line (PL) as defined and adopted by the Planning Commission, Government of India. 'Very Poor'= expenditure level below 75% of PL. 'Moderately poor' = expenditure level between 75% of PL to PL; 'Non-poor lower' = expenditure between PL and 150% of PL; and 'non-poor higher' = above 150% of PL.

[34] The FAO data on dietary energy, protein and fat consumption based on food balance sheet (which refers to availability of food for consumption) indicate a stagnant level of total calorie and protein consumption in India, and a slight increase in fat consumption. However, based on the NSS data, Deaton and Dreze (2009) show the puzzling trend of declining average total calorie and protein consumption in rural India from 1983 to 2005, and no trend in urban India; despite the rising real incomes. Only per capita fat consumption showed a positive trend in this time period. No attempt is made in this study to go into details of level of calorie consumption *per se*, as the focus of this analysis is on the relative importance of pulses versus other food consumed. But Deaton and Dreze (2009) do point to the correlation between declining per capita consumption of cereals (and pulses) and the decline in total calories consumed in rural sector. One of the leading hypotheses they provide for the decline in calorie intake is that it is a reflection of a change in (i.e., lowering of) calorie requirements due mainly to better health and lower activity levels. See Gaiha, Jha and Kulkarni (2010) for alternative hypotheses and explanations of this puzzling fact.

Most of the decline in the share of cereals in calorie consumption between 1993-2004 has come from a concomitant increase in the share of vegetables and fruits across all income groups. Surprisingly, even though the quantities of milk, eggs and chicken meat has increased for all income groups in both rural and urban areas, their share in total calories consumed has not increased. The only other category that has seen its contribution to total calorie consumption increase between 1993-2004 is 'other food,'composed of expensive caloric items such as edible oil, snacks and refreshments.

As indicated before, data on quantities of pulses consumed is not available in published NSS reports beyond 2004-05. An obvious question is—what is the evidence beyond 2005 on consumption of pulses and its importance in Indian diet? The only pulse commodity for which consumption data are reported in NSS reports since report #509 is chickpea (split gram). After recording a steady level of per capita consumption between 1993 to 2004, the consumption of split chickpea in both rural and urban sectors show a decline in 2006-07 and 2007-08 period (Figure A7.6). However, it is difficult to say based on this two additional years of data and one pulse commodity, if this downward trend is generalizable to all the pulses in India.

Figure A7.6: Per capita consumption of split chickpea in rural and urban India, 1993-2008



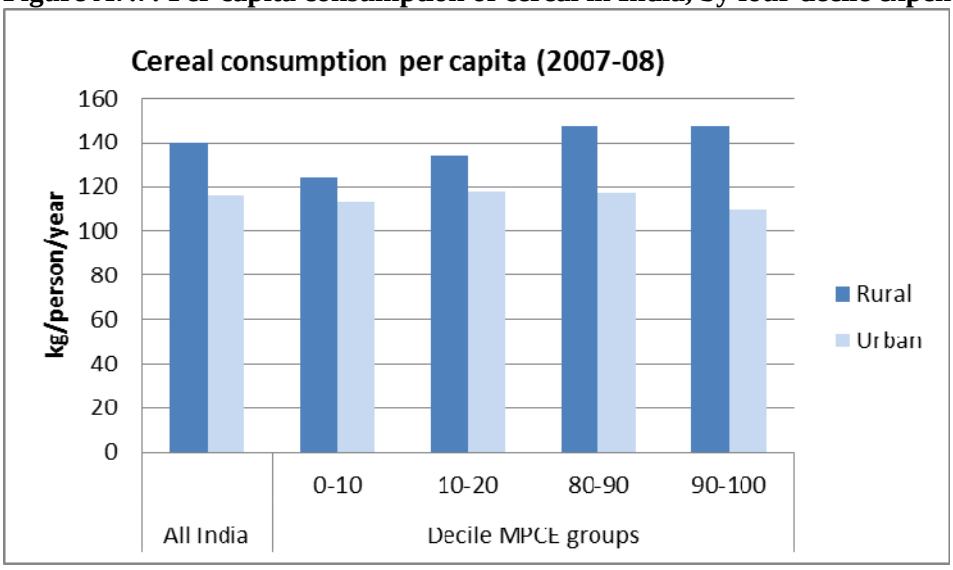
Source: NSSO reports 509, 514, 523, 527, 530

The latest data available for both chickpea and cereal consumption (i.e., 2007-08) are, however, consistent with the previous trend and pattern observed between rural and urban areas and across income groups. For cereals, the per capita consumption is significanlty higher in rural than in urban areas and the correlation between per capita consumption and income level is generally positive in rural areas but overall negative in urban areas (Figure A7.7).

Overall, the per capita consumption of split gram (chickpea) has remained higher in urban areas than in rural areas (by more than 25%), and there is still a positive correlation between per capita consumption of chickpea and income (Figure A7.8). The quantity of chickpea consumed by the 10th decile of the income distribution group is more than three times higher in urban areas and almost 6 times higher in rural areas. What this evidence suggests is that the marginal propensity of chickpea consumption among Indian

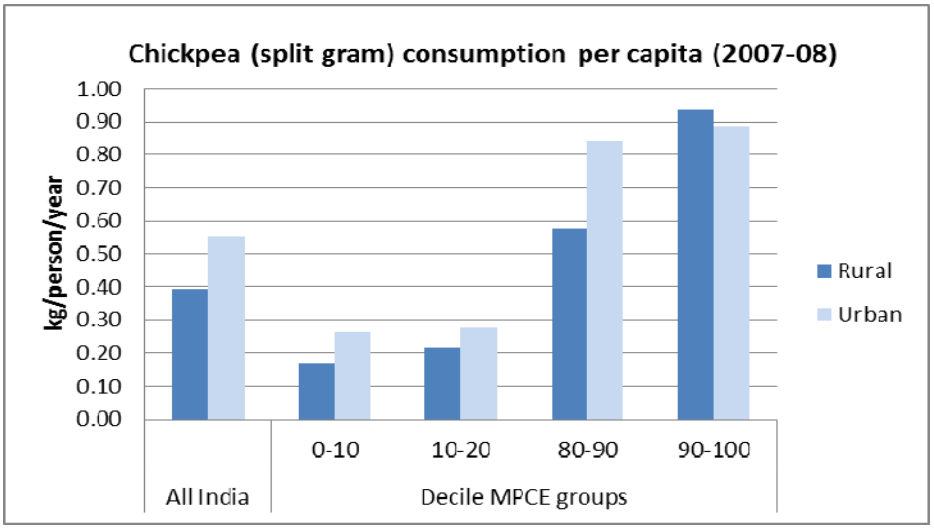
consumers is still much higher (esp. among urban consumers) than the marginal propensity of cereal consumption.[35]

Figure A7.7: Per capita consumption of cereal in India, by four decile expenditure groups, 2007-08



Source: Calculated by the authors based on NSSO report 530
\a Decile groups are defined based on the distribution of 'monthly per capita consumer expenditure' (MPCE), which includes food and non-food consumption. These decile groups are formed separately for rural and urban sectors.

Figure A7.8: Per capita consumption of chickpea in India, by four decile expenditure groups, 2007-08

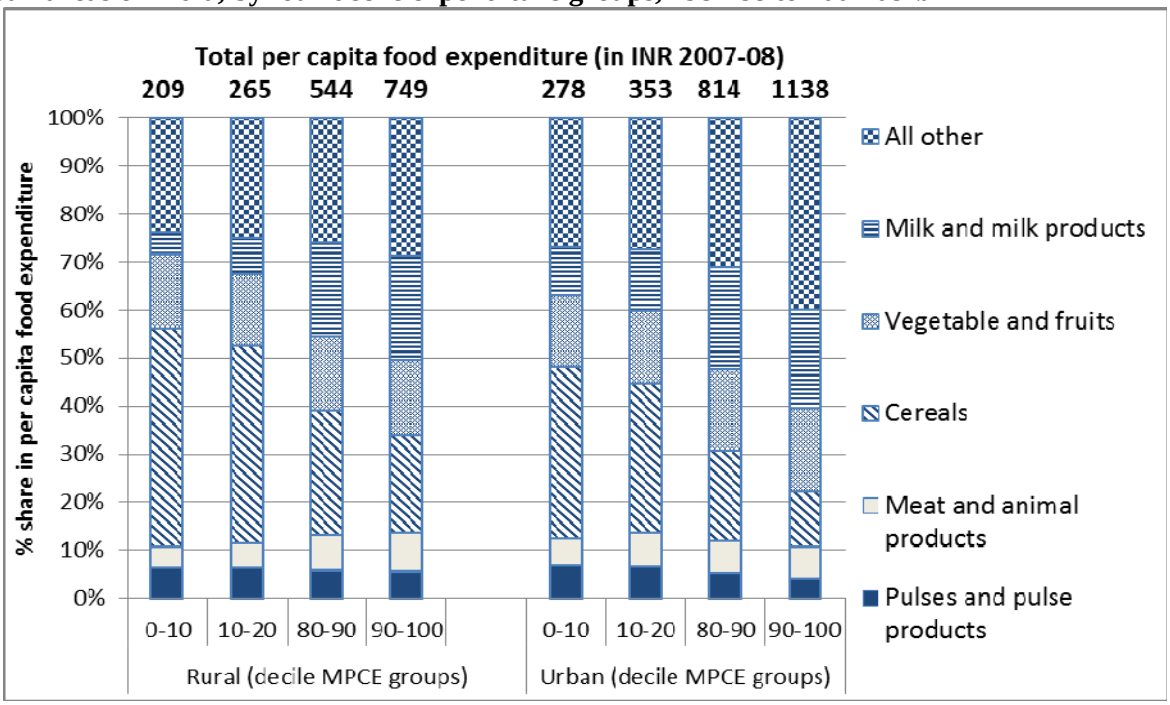


Source: Calculated by the authors based on NSSO report 530
\a Decile groups are defined as noted for Figure A7.7.

[35] This observation may not apply equally to all types of pulses. Hence, caution is warranted in generalizing this observation for all types of pulses; although this observation may likely hold for the aggregated category of 'all pulses.' Also, the quantities of per capita consumption of chickpeas and cereals as a group are of a substantially different magnitude (cereals are consumed in 100s of kgs vs. chickpea consumption is in 100s of grams per year), which adds to this cautionary note.

As real incomes increase, the absolute amount of quantities consumed and money spent on food increases, but the relative share of different types of food in total expentiure changes. Corresponding to the quantity data presented for 2007-08, Figure A7.9 shows the data for per capita food expenditure for major food categories in 2007-08. Wth the rising income, the absolute amount of money spent on food increased from Rs. 209 for the lowest decile group in rural areas to Rs. 749 for the highest decile group. Similarly, the per capita expenditure on food increased from Rs. 278 in the lowest decile group to more than Rs 1000 for the highest decile group. Concommitant to this increase, the relative share of all the food items in total food expenditure increases, but at the expense of declining shares for cereals and pulses in both the rural and urban sectors (Figure A7.9). The decline in the share of cereals in total food expenditure basket is much more dramatic (55% and 68% decline from the 1st decile to the 10th decile in the rural and urban areas, respectively) than for pulses (13% and 39% decline from the 1st to the 10th decile in the rural and urban areas, respectively). With the rise in income (measured by expenditure level), the share of milk and milk products in total food expenditure increases at a much higher rate than any other food category (Figure A7.9). With increasing income, the share of 'all other' foods (i.e., beverages, spices, snacks, edible oil, sugar, etc.) in food expenditure basket also increases. The status of cereals as the category of food capturing the highest share in monthly food expenditure among the lowest decile group is replaced by 'all other' foods (i.e., beverages, spices, snacks, edible oil, sugar, etc.) in the highest declie group in both rural and urban areas.

Figure A7.9: Share of major food categories in total per capita food expenditure in rural and urban areas of India, by four decile expenditure groups, 1987-88 to 2007-08 \a

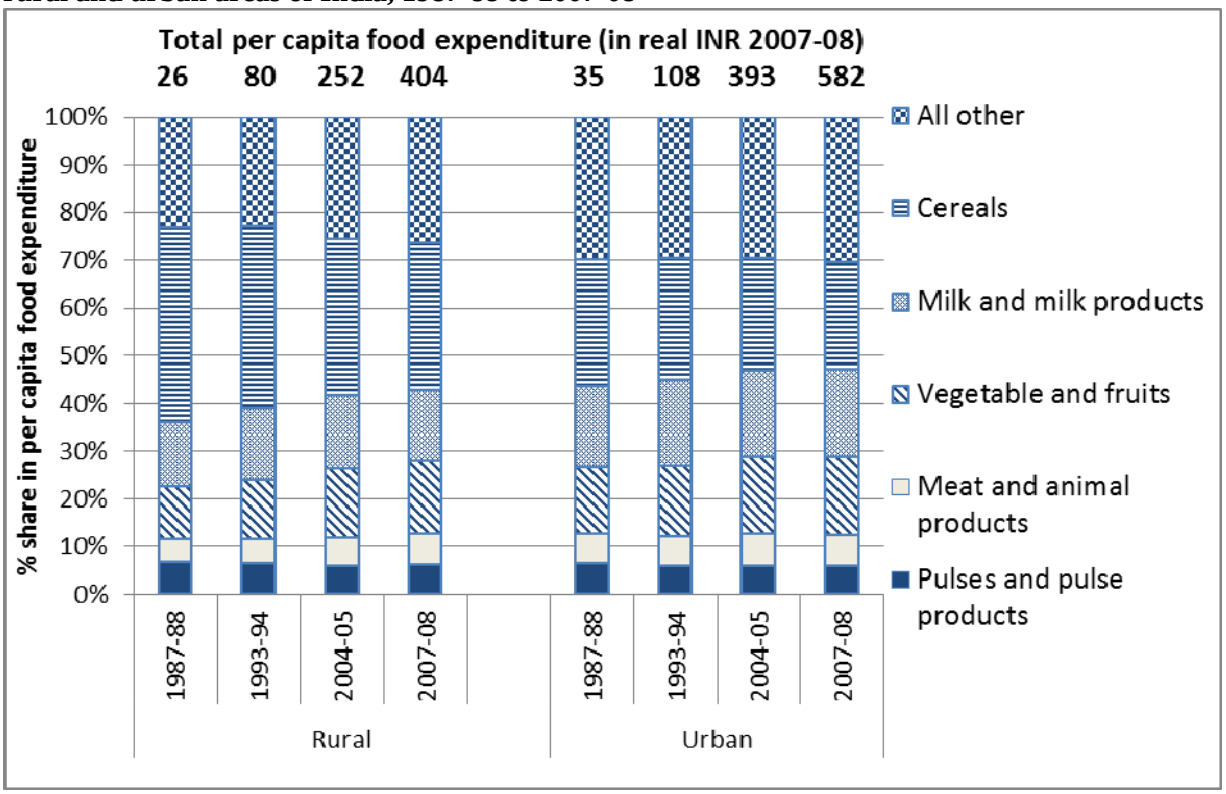


Source: Calculated by the authors based on NSSO reports 514, 523, 527, 530
\a Decile groups are defined based on the distribution of 'monthly per capita consumer expenditure' (MPCE), which includes food and non-food consumption. These decile groups are formed separately for rural and urban sector.

The relative importance of meat and animal products in monthly food expenditure does not show a big increase from lower to the higher end of the MPCE distribution group in urban areas as it does in the rural areas. Overall, the highest decile group of consumers spend less than 10% of their total expenditure on meat and animal products (including, eggs and fish). Thus, despite higher income, there does not seem to

be a significant shift towards more expensive protein foods, eventhough as the consumption of less expensive sources of calories and protein in the form of cereals and pulses has declined. Among the lowest two decile groups, the share of pulses in total food expenditure is higher than the share of meat and animal products. Thus, next to cereals, pulses still remain the main source of protein for the lower expenditure classes.

Figure A7.10: Change in the share of major food categories in total per capita food expenditure in rural and urban areas of India, 1987-88 to 2007-08



Source: Calculated by the authors based on NSSO *reports 514, 523, 527, 530*

Across all decile groups, the share of pulses in the total food expenditure in 2007-08 averaged 6.1% in rural areas and 5.7% in urban areas, which was a slightly smaller share than for meat and animal products in total expenditure (6.5% in rural and 6.8% in urban areas) (Figure A7.10). The average share for pulses in total expenditure has declined steadily over the last 20 years (1987 to 2007) at a rate of 0.5%/year, which is half the rate of decline observed for cereals (Figure A7.10). During this same time period, vegetables and fruits have seen the highest growth rate in the share in total food expenditure as it increased its share from 10.7% in 1997 to 15.4% in 2007-08 in rural areas and from 13.9% to 16.4% over the same time period in urban areas.