

World Soybean Production: Area Harvested, Yield, and Long-Term Projections

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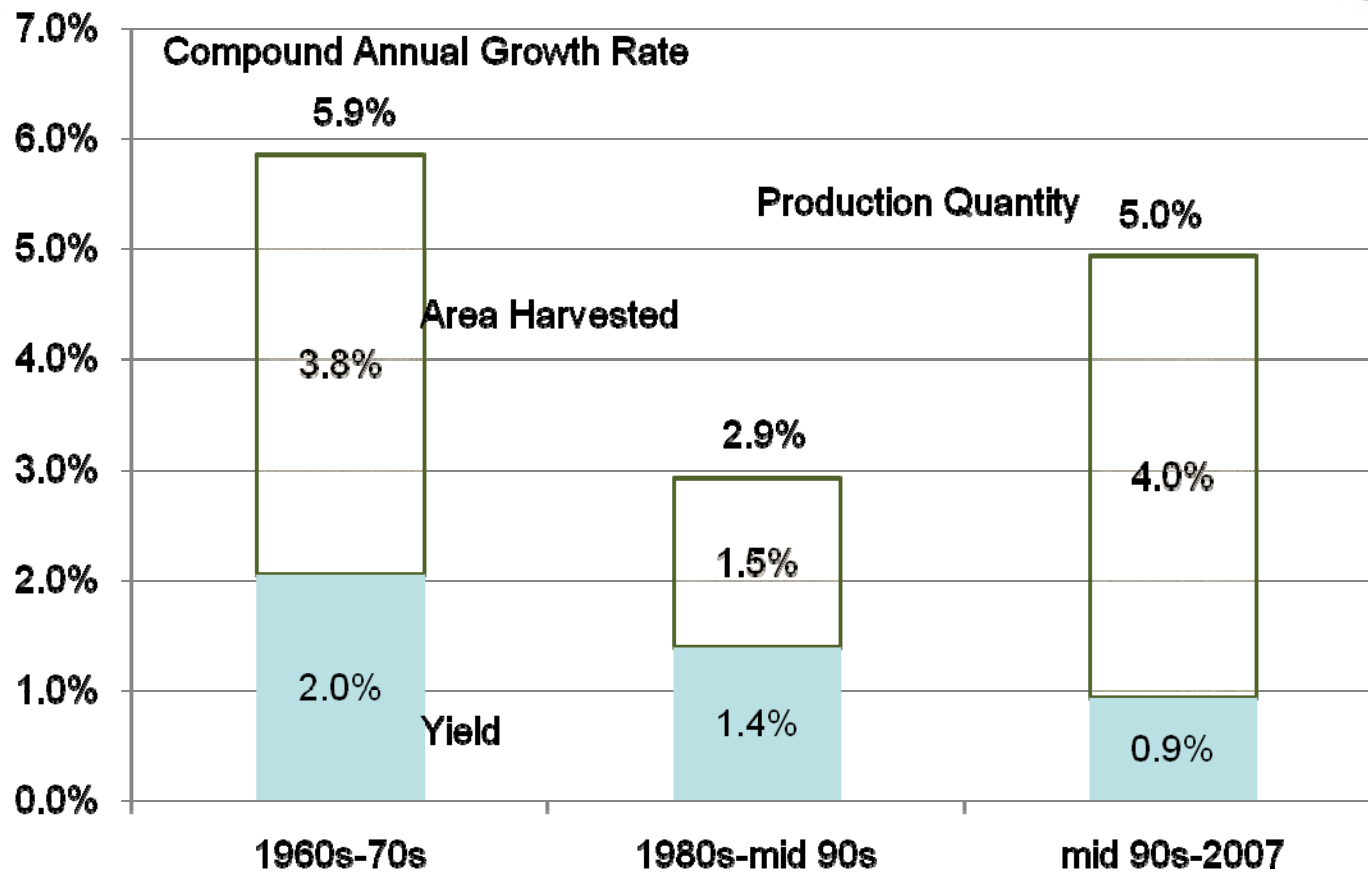
Introduction

- Soybeans in the world
 - Valuable crop as **feed, fuel, and food**
 - Production quantity increased by **4.8% annually 1961-2007** and reached **217.6 million metric tons**.
- Objectives
 - To examine the **contribution of increased area harvested and yield** to overall production.
 - To estimate the **long range production quantities** at the national and international levels.
 - Scenario analysis of yield and area harvested to 2030

Methodology

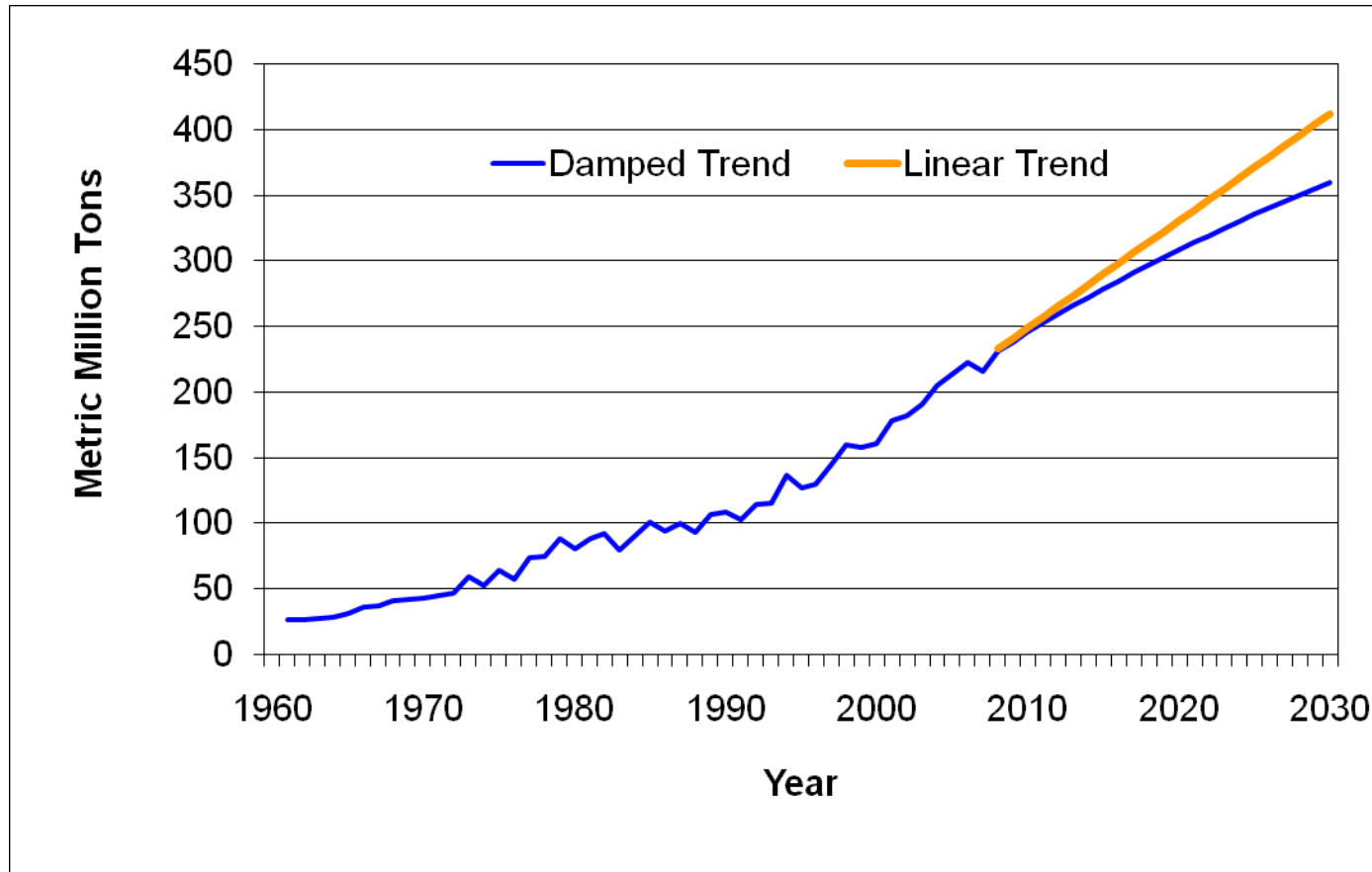
- Exponential Smoothing with a damped trend
 - Univariate time series model, Prod. Quantity: $P_t = L_t + T_t \times t + \epsilon_t$
 - The smoothing equations are:
 - Level: $L_t = \alpha P_t + (1-\alpha)(L_{t-1} + \varphi T_{t-1})$, and
 - Trend: $T_t = \gamma(L_t - L_{t-1}) + (1-\gamma)\varphi T_{t-1}$
 - Consider plateau and set $\varphi=0.98$ then minimize mean square error (MSE) to decide α & γ by country/continent.
- Scenarios
 - 1. Yield annual growth keeps the same rate.
 - 2. Global annual yield level reaches 3.5ha/ton in 2030.
 - 3. Annual yield growth slows to 0.5% annually.

Figure 1. Compound Annual Growth Rates for World Soybean Production Quantity, Area Harvested, and Yield



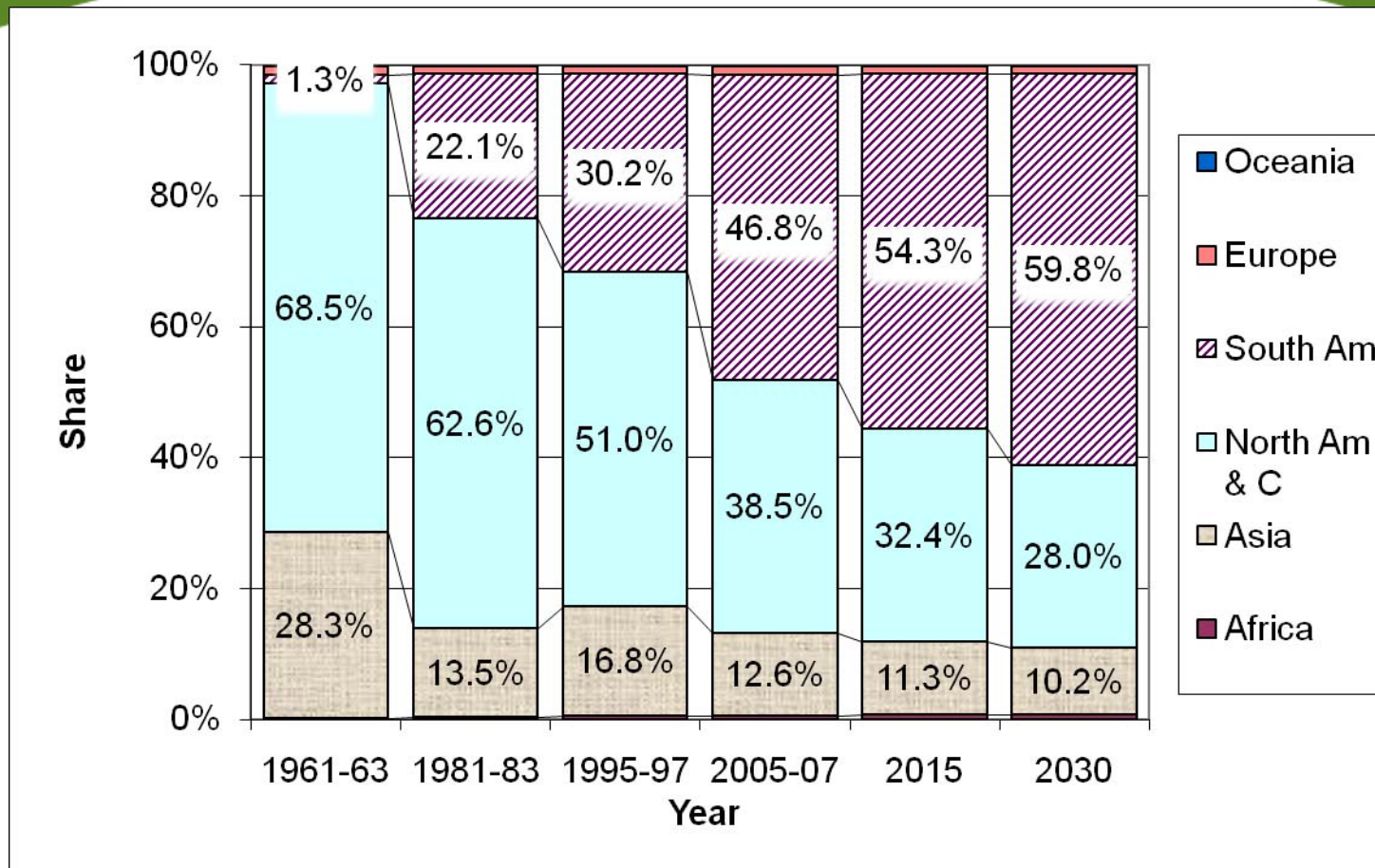
Source: FAOSTAT and authors' calculation.

Figure 2. World Soybean Production Quantity



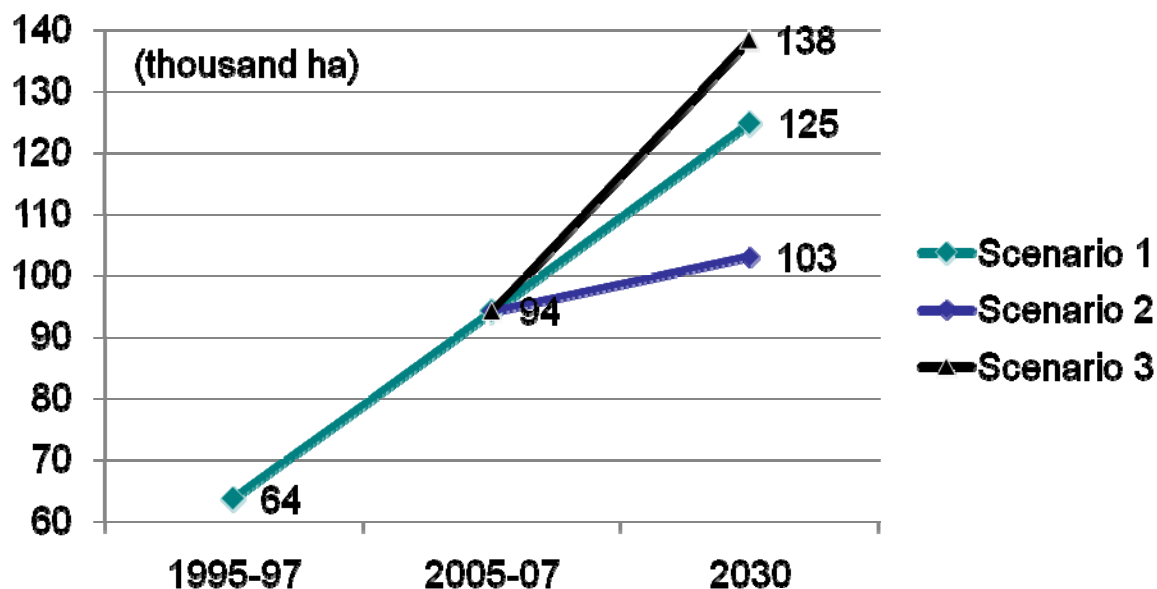
Source: FAOSTAT and authors' calculation.

Figure 3. Shifts of Soybean Production Quantity Share by Continent



Source: FAOSTAT and authors' calculation.

Figure 4 & Table 10. Scenarios for Soybean Area Harvested to 2030



World Total/Average	Year 2005-07		Year 2030	
	a	CAGR*	b	b/a
Production Quantity (thousand metric tons)	217.6	2.1%	359.7	1.7
Scenario 1 Area Harvested (thousand ha)	94.1	1.2%	124.8	1.3
Yield (tons/ha)	2.3	0.9%	2.9	1.2
Scenario 2 Area Harvested (thousand ha)	94.1	0.4%	102.9	1.1
Yield (tons/ha)	2.3	1.7%	3.5	1.5
Scenario 3 Area Harvested (thousand ha)	94.1	1.6%	138.2	1.5
Yield (tons/ha)	2.3	0.5%	2.6	1.1

Note. *Compound Annual Growth Rate.

Source: FAOSTAT and authors' calculation.

Table 2. World Soybean Production (Thousand Metric Tons)

continent/country	3-Year Average				Projections		CAGR*
	1961-63	1981-83	1995-97	2005-07	2015	2030	2005-30
World +	27,403	86,705	133,874	217,598	278,472	359,694	2.1%
Africa +	81	376	730	1,375	1,902	2,527	2.6%
Asia +	7,751	11,668	22,467	27,357	31,427	36,776	1.2%
-- China	6,597	9,384	13,827	15,817	16,817	18,260	0.6%
-- India	6	486	5,653	8,855	11,455	14,693	2.1%
-- Rest of Asia	1,148	1,798	2,987	2,686	3,155	3,824	1.5%
N Am & C +	18,779	54,272	68,332	83,877	90,308	100,694	0.8%
-- USA	18,570	52,855	65,711	80,582	86,796	96,565	0.8%
-- Canada	165	730	2,400	3,136	3,429	4,082	1.1%
-- Rest of N Am & C	44	687	221	160	84	46	-5.0%
South America +	355	19,140	40,456	101,790	151,173	214,943	3.2%
-- Brazil	313	14,142	25,076	53,948	74,676	100,679	2.6%
-- Argentina	10	3,973	11,862	41,422	67,870	102,925	3.9%
-- Paraguay	4	789	2,426	3,896	4,441	5,056	1.1%
-- Rest of S Am	27	236	1,092	2,524	4,187	6,283	3.9%
Europe +	437	1,180	1,840	3,153	3,633	4,744	1.7%
-- Ukraine + Russia	n/a	n/a	303	1,495	2,486	3,906	4.1%
-- Rest of Europe	n/a	n/a	1,538	1,658	1,147	838	-2.8%
Oceania +	0	68	49	46	29	9	-6.5%

Note. *Compound Annual Growth Rate.

Source: FAOSTAT and authors' calculation.

Table 3. World Soybean Production (Quantity Share)

continent/country	3-Year Average				Projections	
	1961-63	1981-83	1995-97	2005-07	2015	2030
World +	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Africa +	0.3%	0.4%	0.5%	0.6%	0.7%	0.7%
Asia +	28.3%	13.5%	16.8%	12.6%	11.3%	10.2%
-- China	24.1%	10.8%	10.3%	7.3%	6.0%	5.1%
-- India	0.0%	0.6%	4.2%	4.1%	4.1%	4.1%
-- Rest of Asia	4.2%	2.1%	2.2%	1.2%	1.1%	1.1%
N Am & C +	68.5%	62.6%	51.0%	38.5%	32.4%	28.0%
-- USA	67.8%	61.0%	49.1%	37.0%	31.2%	26.8%
-- Canada	0.6%	0.8%	1.8%	1.4%	1.2%	1.1%
-- Rest of N Am & C	0.2%	0.8%	0.2%	0.1%	0.0%	0.0%
South America +	1.3%	22.1%	30.2%	46.8%	54.3%	59.8%
-- Brazil	1.1%	16.3%	18.7%	24.8%	26.8%	28.0%
-- Argentina	0.0%	4.6%	8.9%	19.0%	24.4%	28.6%
-- Paraguay	0.0%	0.9%	1.8%	1.8%	1.6%	1.4%
-- Rest of S Am	0.1%	0.3%	0.8%	1.2%	1.5%	1.7%
Europe +	1.6%	1.4%	1.4%	1.4%	1.3%	1.3%
-- Ukraine + Russia	n/a	n/a	0.2%	0.7%	0.9%	1.1%
-- Rest of Europe	n/a	n/a	1.1%	0.8%	0.4%	0.2%
Oceania +	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%

Source: FAOSTAT and authors' calculation.

Implications & Discussion

- Arable land on the globe is limited and the competition from other crops **restricts the soybean area expansion**.
- International community values **environmental stewardship and biome preservation**.
- **Yield improvement** appears to be essential:
 - Substantial R&D investments in genetics and agronomics
 - Technological transfers to low-yield areas
 - Intellectual property issues