Factors Contributing to Zambia's 2010 Maize Bumper Harvest

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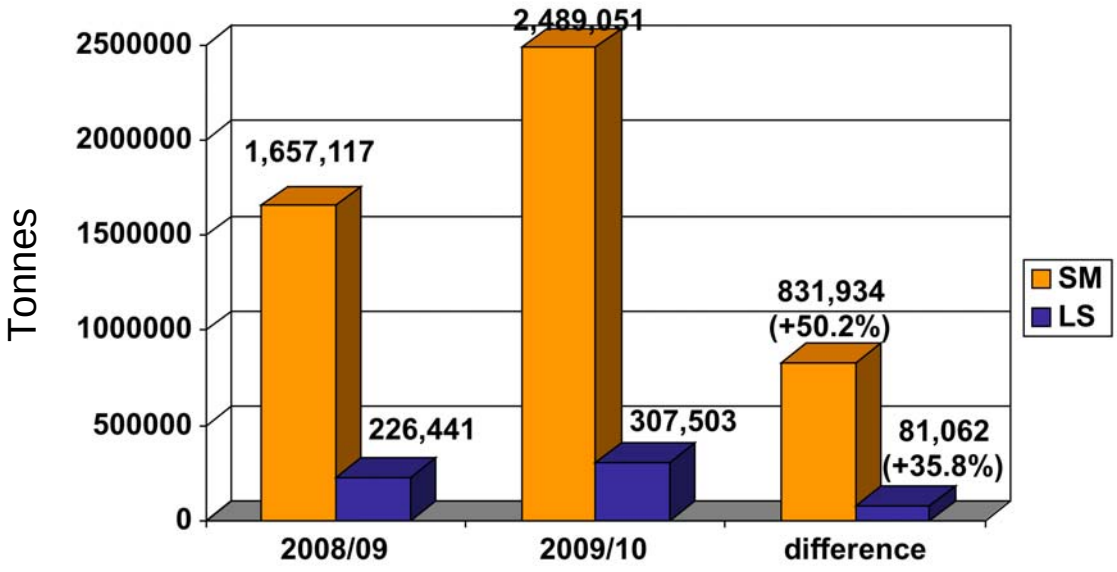
Introduction

- Zambian maize production increased by roughly 48% from the 2009 to the 2010 harvests.
- Increases occurred in both the small-scale and commercial farm sectors

2008/09 vs. 2009/10 CFS Maize Production Estimates



Where did the growth in maize production come from?

Objectives

I. Understand the key sources of maize production growth from 2009 to 2010 (yield, minimization of crop loss/abandonment and area expansion)

II. Determine which factors have driven changes in these sources and determine their relative importance (e.g. fertilizer, weather, seed use and others) .

III. What can Zambia learn from the 2009/10 bumper harvest.

Data

- Data used comes from the 2005/06, 2006/07, 2007/08, 2008/09 and 2009/10 Crop Forecast Surveys
- Collected annually by the Ministry of Agriculture and Cooperatives (MACO) in collaboration with the Central statistical Office

Contributions to Growth

Δ Production = Δ Yield + Δ Ratio of harvested to planted area + Δ Area planted

Mathematically

$$prod = y \cdot ah = y \cdot \frac{ah}{ap} \cdot ap$$

Definitions
prod=production
y=yield
ah=area harvested
ap=area planted
Δ=change

Based on the total derivative:

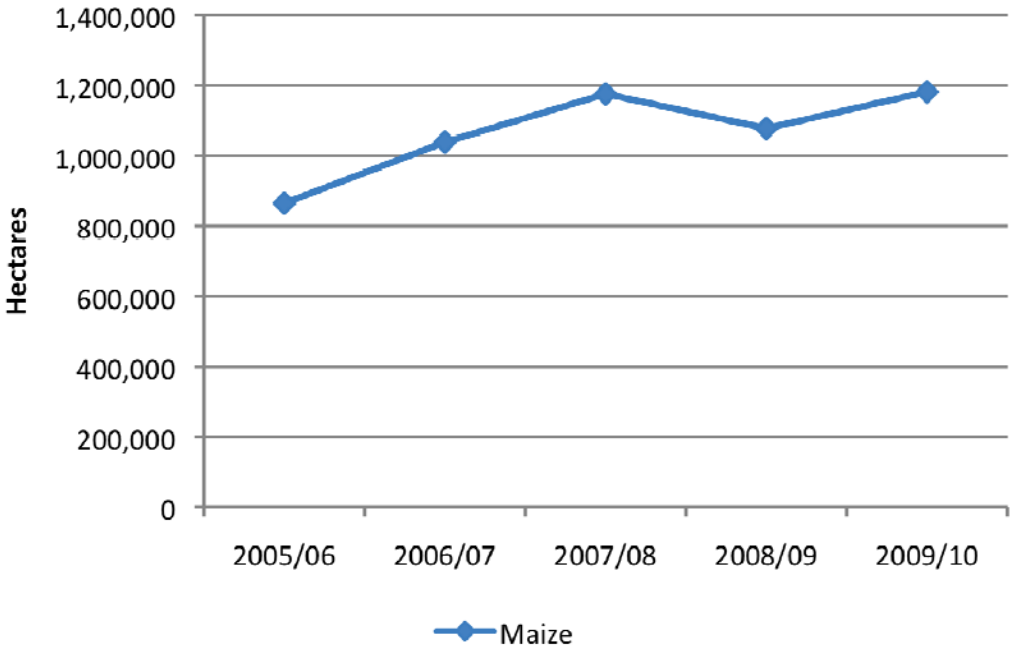
$$\frac{\Delta prod}{\Delta prod} = \frac{\Delta y\left(\frac{ah}{ap} \cdot ap\right)}{\Delta prod} + \frac{\Delta \frac{ah}{ap}\left(y \cdot ap\right)}{\Delta prod} + \frac{\Delta ap\left(y \cdot \frac{ah}{ap}\right)}{\Delta prod}$$

Contributions Within Each Province to Production Growth

Province	% relative contribution to production growth between 2009-2010 harvests from changes in		
	Yield	Ratio of Harvested to Planted Land	Area Expansion
Central	45	24	31
Copperbelt	47	2	51
Eastern	102	0	-2
Luapula	59	1	40
Lusaka	51	16	32
Northern	39	1	60
Northwestern	56	7	37
Southern	45	31	24
Western	47	58	-4
All Zambia	59	18	23

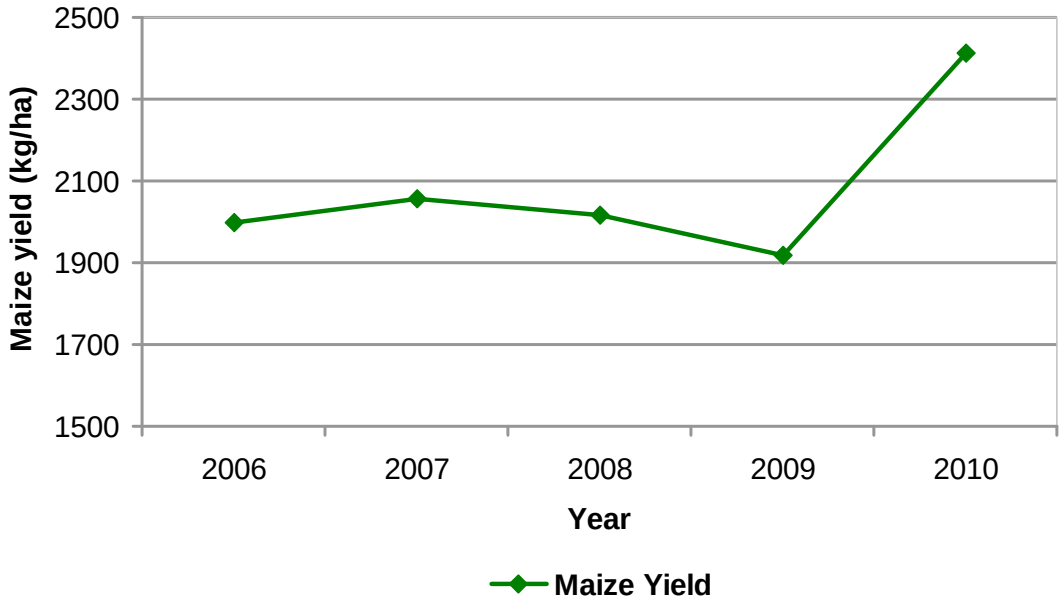
Source: Central Statistics Office Crop Forecast Survey 2008/09, 2009/10
Note: Rows sum to 100

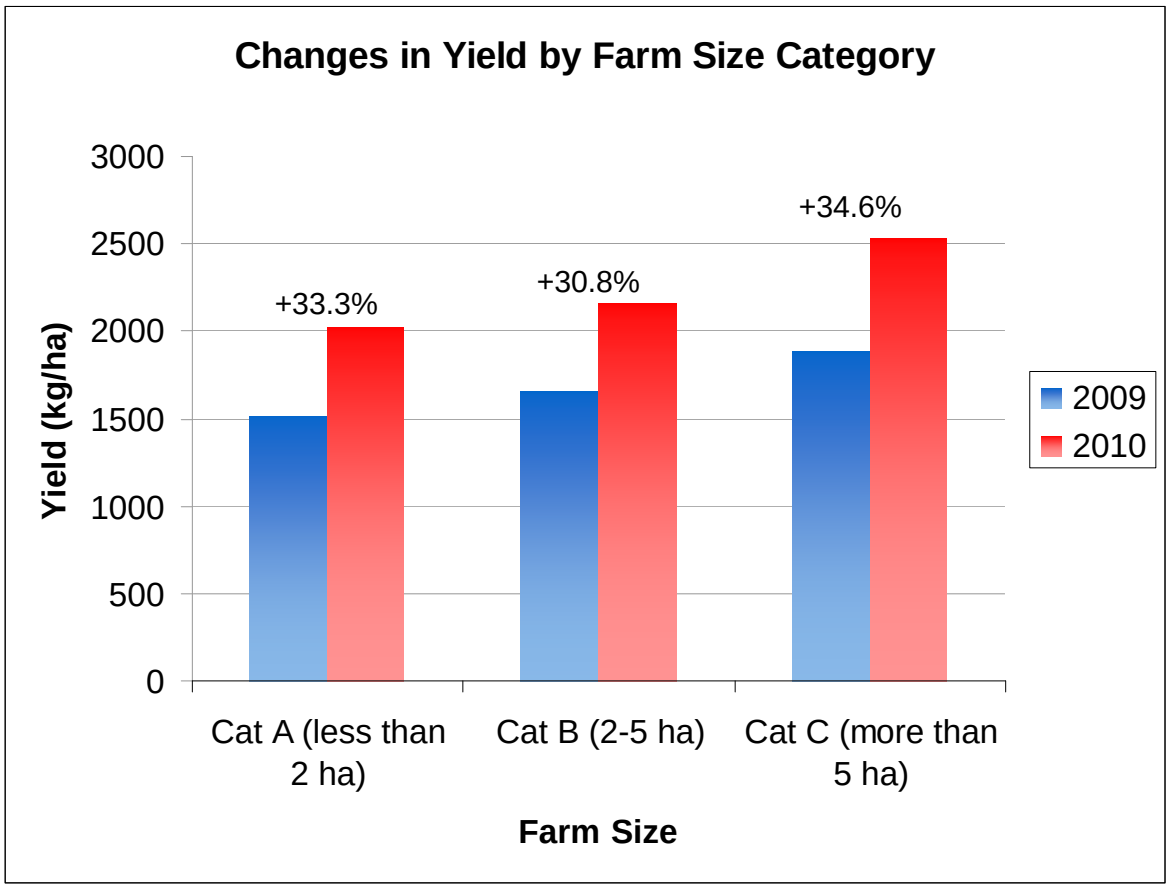
Total area planted by small/medium-scale Agricultural households, 2005/06-2009/10



Percent of maize area planted to be harvested, 2000/01-2009/10

National Maize Yield for small/medium-scale Agricultural households, 2005/06-2009/10





Yield Regression Analysis

Using CFS data from 2006-10

Management:	Weather:	Interactions:
Basal Dressing Top Dressing Seed type Nitrogen fixer intercrop Other intercrop Tillage type Tillage timing Field size	Rainfall Rainfall stress AEZ Year dummies	The model allows the yield response rate to fertilizer to be conditional on all other explanatory variables.

Post-estimation Simulations

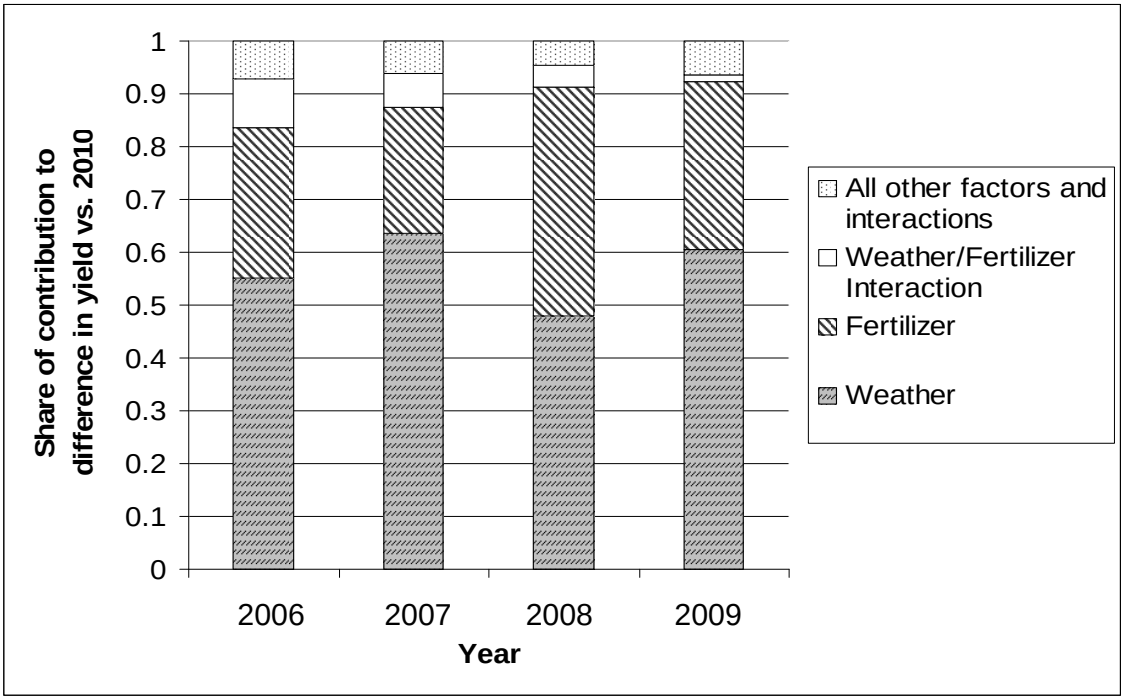
Changes that drove yield increase

	Results		
Simulations changing specific factors from their 2009 to 2010 values. 2010 values used are:	Yield Prediction (kg/ha)	% change vs. 2009	Contribution to total change
i) None (2009 prediction)	2,079	-	-
ii) All (2010 prediction)	2,522	21.3%	100%
iii) Weather	2,346	12.9%	61%
iv) Fertilizer	2,219	6.7%	32%
v) Purchased hybrid seed use	2,099	1.0%	5%
vi) Weather and fertilizer	2,493	19.9%	94%
vii) Weather, fertilizer and seed use	2,514	20.9%	98%

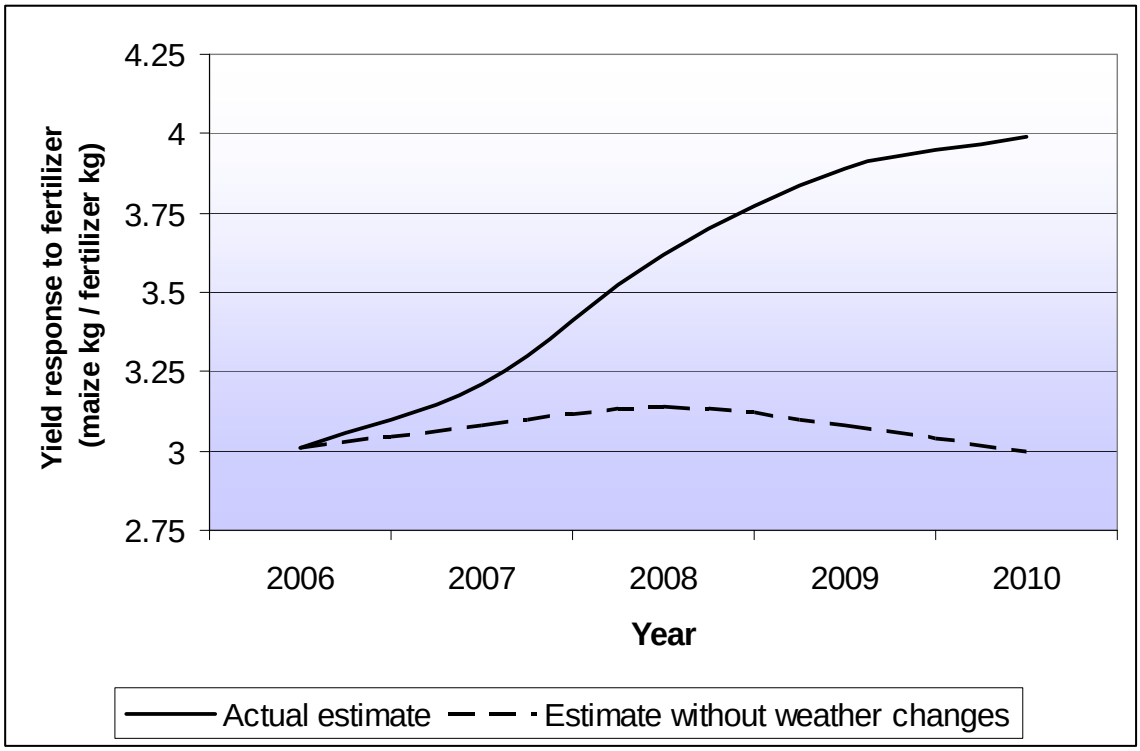
Yield Regression Analysis

- Yield increase from 2009 to 2010 was greater than 21%
- If **only** fertilizer (FISP *and* private sector) changes, increase is 6.7%
- If **only** weather changes, increase is 12.9%
- The majority of the increase in yield can be attributed to fertilizer and weather.
- Moderate increase in improved seed use also contributed.

Comparing the 2010 harvest to earlier years



Yield Response to Fertilizer use over time



Conservation Farming

- Highly effective
- Not enough change in adoption to affect change in national production
  - CFS data not designed to sufficiently capture the relatively few households practicing CF on maize production.
  - Initial estimates indicate minimal contribution of CF to the growth in national production

Conclusions

The difference in Zambian maize harvest from 2009 to 2010 (831,934 mt) can be attributed to:

Unusually favorable weather (390,759 mt)	47%
Increased fertilizer use (204,989 mt)	25%
Area Expansion (191,345 mt)	23%
Increased use of hybrid maize seed (32,029 mt)	4%
Improved management (12,812 mt)	2%

What can we learn?

- Though Zambia had a good harvest in 2010, the country remains vulnerable to shifts in weather conditions.
- Under good conditions Zambia can produce a substantial surplus but without a stable maize marketing policy, the development of a vibrant local and export market will continue to be hampered.

What can we learn?

- When trading maize, marketing issues are international, so we can not make policies in a vacuum.
  - We can not set the world price.
  - If world price is below "cost of production," is this an appropriate method for setting FRA prices and can we afford to use it?
  - Don't we risk subsidizing other countries who can cross the border to sell to FRA?
- So – how do we provide sustainable incentives to farmers to continue producing maize surpluses?

Acknowledgements

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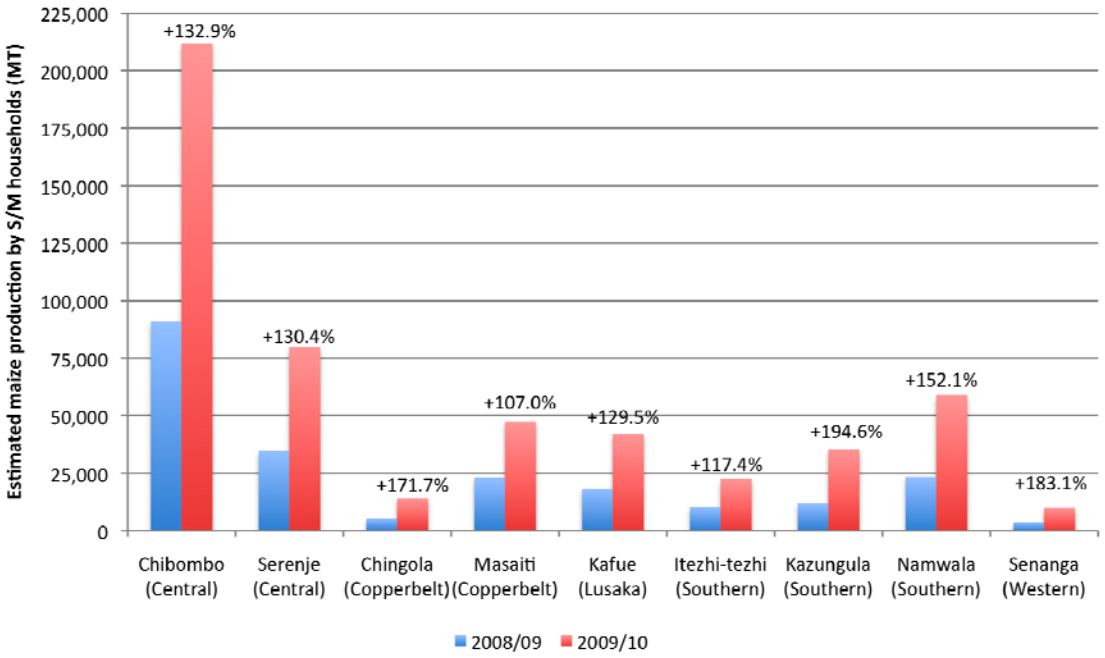
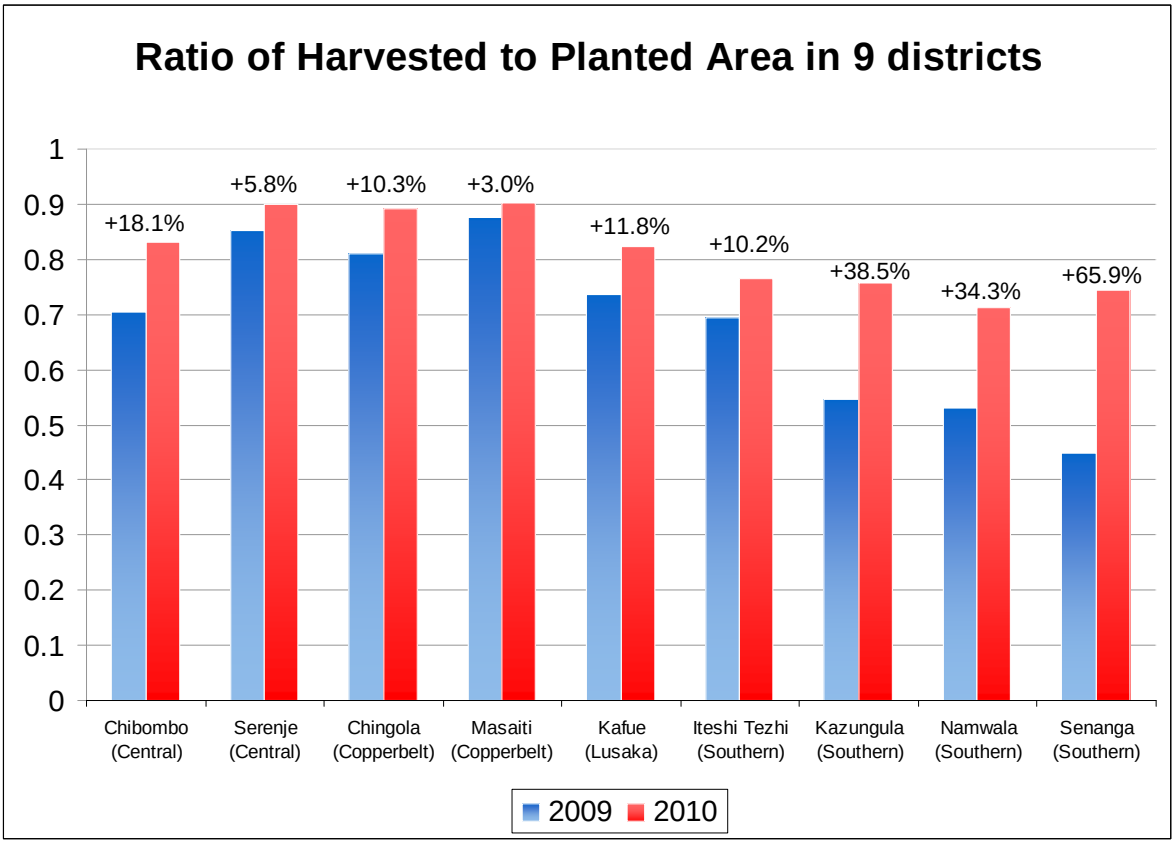
  - Dingi Banda, Michael Isimwaa, Nicolas Mwale, Derrick Sikombe, Nicole Mason, Margaret Beaver, Munguzwe Hichaambwa, Michael Weber, and Steve Longabaugh.

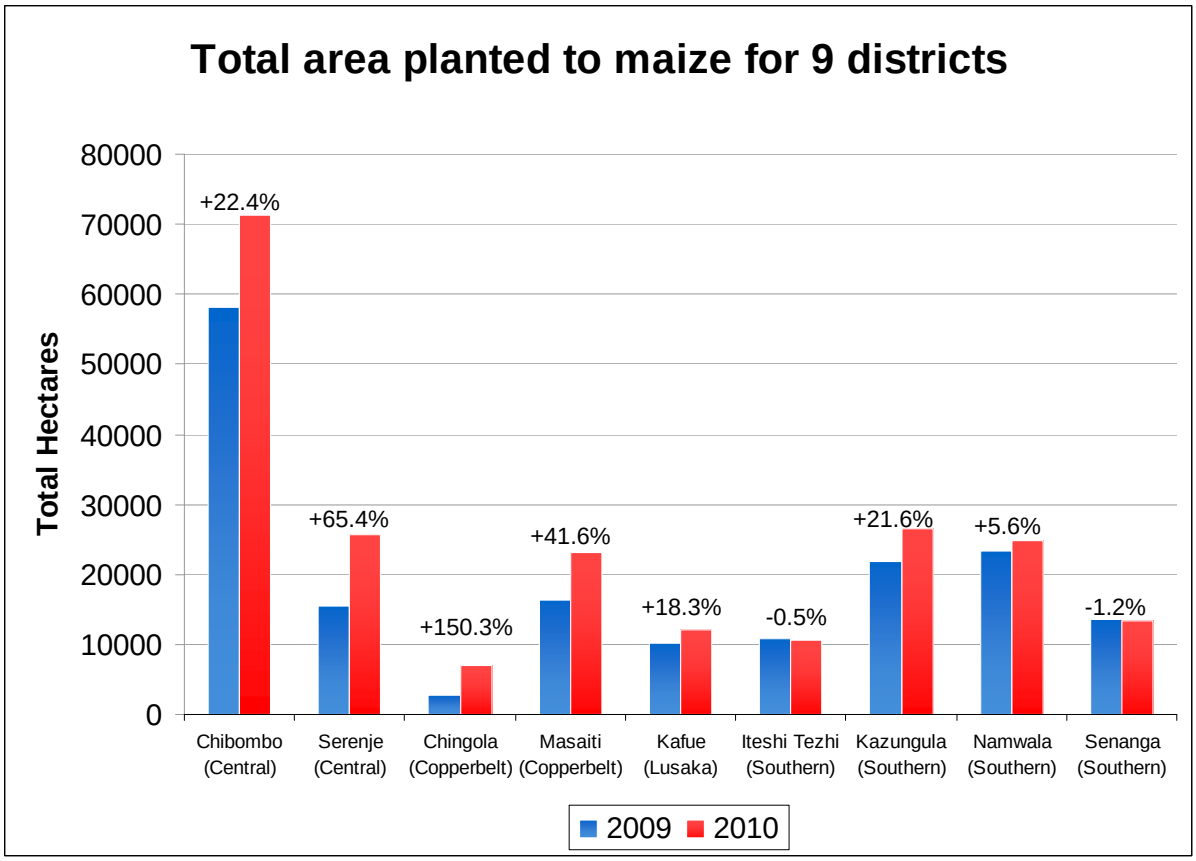
Thank you

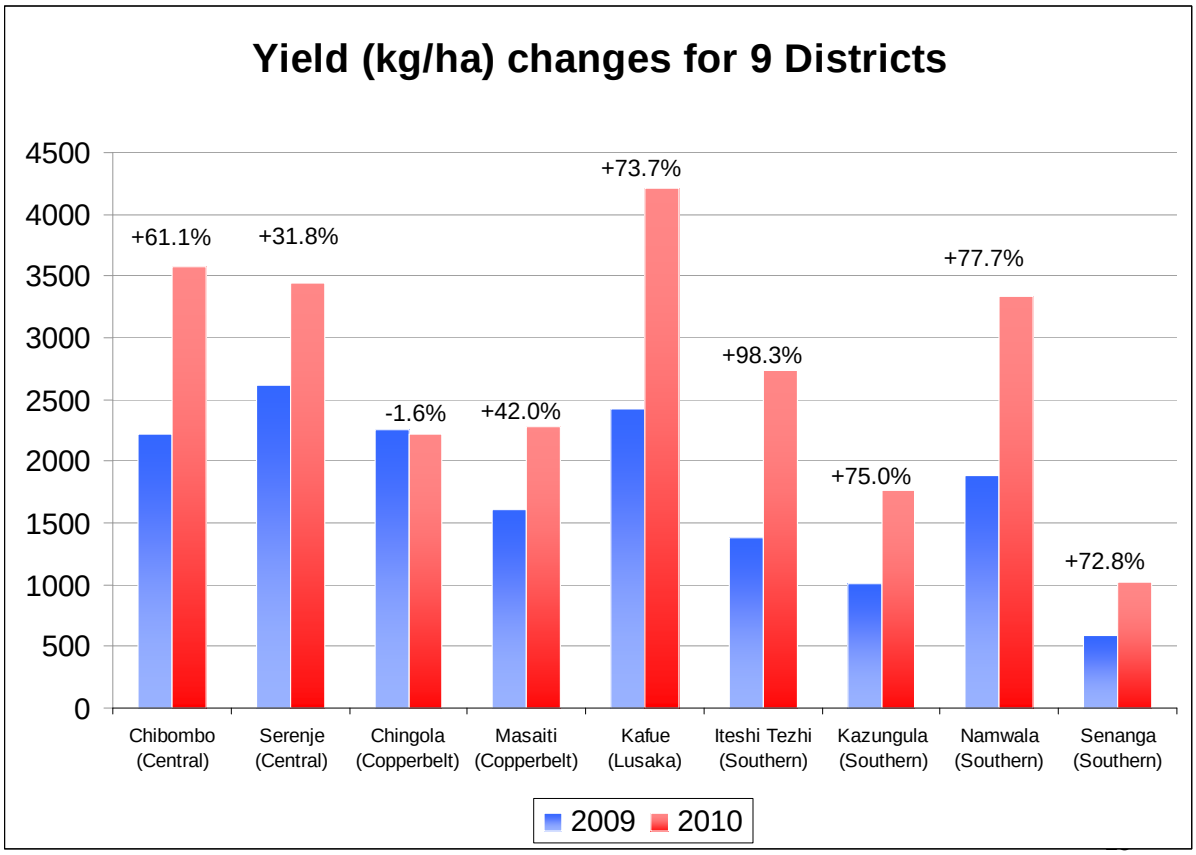
Bonus Slides

In 9 districts, 2009/10 expected total S/M maize production more than double 2008/09 level






Total area planted to maize for 9 districts
Total Hectares
80000
70000
60000
50000
40000
30000
20000
10000
0
+22.4%
+65.4%
+150.3%
+41.6%
+18.3%
-0.5%
+21.6%
+5.6%
-1.2%
Chibombo (Central)
Serenje (Central)
Chingola (Copperbelt)
Masaiti (Copperbelt)
Kafue (Lusaka)
Iteshi Tezhi (Southern)
Kazungula (Southern)
Namwala (Southern)
Senanga (Southern)
2009
2010


Yield (kg/ha) changes for 9 Districts
4500
4000
3500
3000
2500
2000
1500
1000
500
0
+61.1%
+31.8%
-1.6%
+42.0%
+73.7%
+98.3%
+75.0%
+77.7%
+72.8%
Chibombo (Central)
Serenje (Central)
Chingola (Copperbelt)
Masaiti (Copperbelt)
Kafue (Lusaka)
Iteshi Tezhi (Southern)
Kazungula (Southern)
Namwala (Southern)
Senanga (Southern)
2009
2010

Increase in 2009/10 maize output due to expected increase in maize price:

	Price expectation based on prior year price (May-Oct): Market / FRA	%Δ Qmz / %Δ Pmz	Incremental maize output due to change in expected mz price
2008/09	943 / 1100 kw/kg		
2009/10	1205 / 1300 kw/kg		
difference	+28% / +18%	+0.3 +0.5	83,000 to 232,000 mt

- Therefore, roughly 83,000 to 232,000 of the 831,934 tons of incremental maize production (10% to 28%) can be attributed to expectation of increased maize price in 2009/10 compared to 2008/09.
- This is consistent with the calculated contribution from area expansion (23%).