



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative



Quality Assessment of Herbicides sold in Mali: Preliminary Laboratory Results

Steven Haggblade and Amadou Diarra

Presented to the Comite Sahelien des Pesticides (CSP)

Bamako, Mali

May 22, 2018



MICHIGAN STATE
UNIVERSITY



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

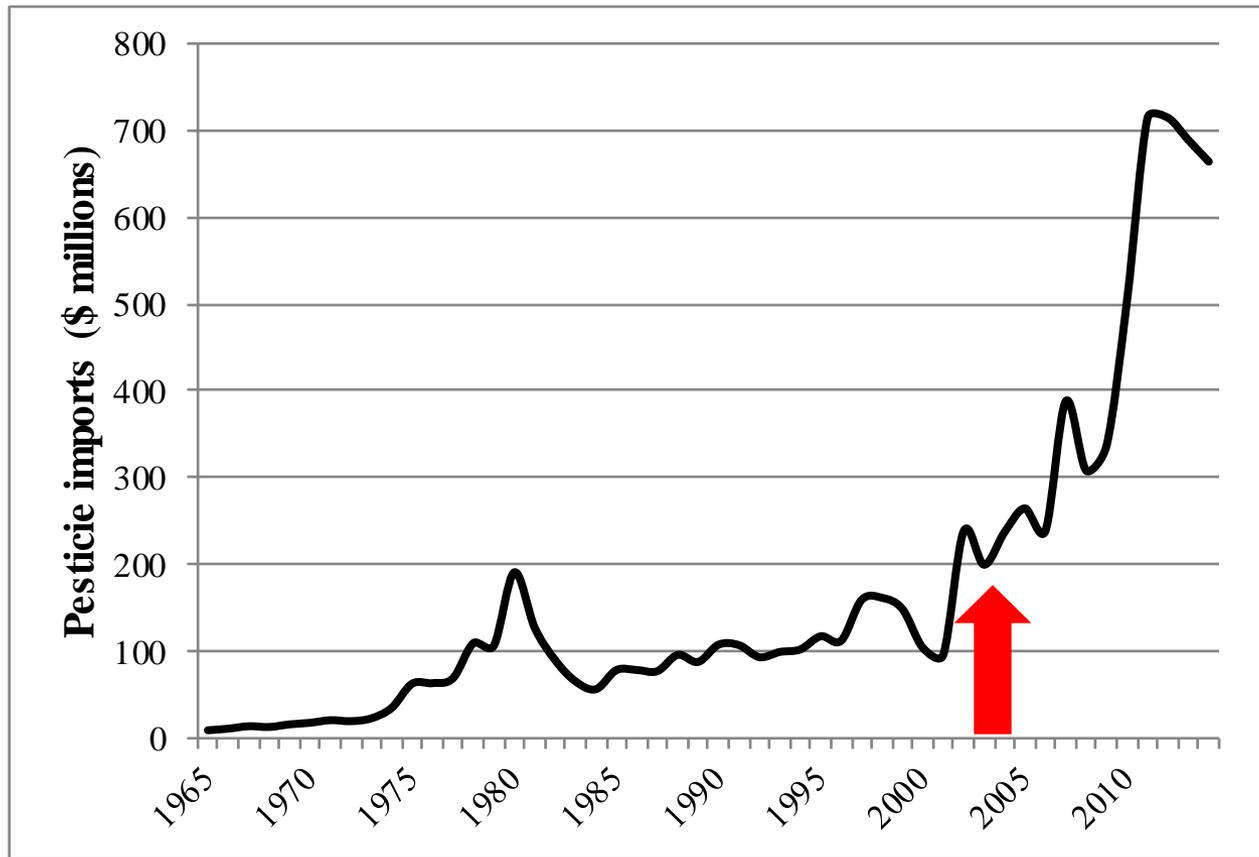


Outline

- 1. Quality implications of rapid market growth**
- 2. Sampling of pesticides sold**
- 3. Preliminary testing results**

1. Rapid market growth

Figure 1. Pesticide import trends in West Africa



Source : COMTRADE (2017)

Herbicides dominate

Table 1. Pesticide imports into West Africa, 2015*

Pesticide products	Imports	
	\$ millions	percent
Herbicides	552	62%
Insecticides	229	26%
Others**	104	12%
Total	885	100%

* average, 2014 to 2016

** fungicides, growth regulators, rodenticides, nematicides

Source: COMTRADE (2017), FAOSTAT (2017).

Glyphosate dominates among herbicides

Figure 2. Roundup and early imitations



Consequences of rapid market growth

- **New traders**
- Proliferating brands
- Counterfeit and unregistered products

	2000	2016	annual growth rate
Côte d'Ivoire			
importers	12	67	11%
retailers	113	779	13%
applicators	44	396	15%
Guinea			
importers	2	21	16%

Sources: Traore and Haggblade (2017a, 2017b).

Consequences of rapid market growth

- **New traders**
- Proliferating brands
- Counterfeit and unregistered products



Consequences of rapid market growth

- New traders
- **Proliferating brands**
- Counterfeit and unregistered products

Figure 3. Roundup and imitations



Consequences of rapid market growth

- New traders
- **Proliferating brands**
- Counterfeit and unregistered products

Figure 4. The Red Berets



Consequences of rapid market growth

- New traders
- Proliferating brands
- **Counterfeit and unregistered products**



Farmers ask

- **Why quality varies?**
- **Are some adulterated?**
- **under-dosed?**
- **Which products are reliable?**
- **How to identify good quality products?**



Outline

1. **Quality implications of rapid market growth**
2. **Sampling of pesticides sold**
3. **Preliminary testing results**

Sampling methods

- Visit major agricultural markets in 4 zones (Bamako, Sikasso, Koutiala et Niono)
- List all pesticide retailers
- Select 10 retailers at random
- Purchase 2 bottles of glyphosate from each
 - Cheapest
 - Top quality as recommended by retailer

Resulting sample

Purchase location	sample size
Bamako	
central market	27
other markets	13
Niono	30
Sikasso	16
Koutiala	14
total	100

Resulting sample

Country of fabrication	sample size
China	63
Belgium	12
France	6
India	2
Ghana	1
Mexico	1
not indicated	15
total	100

Resulting sample

Registration status	sample size
CILSS	55
other	6
none	39
total	100

Resulting sample

Sample characteristics	mean	s.d.	min	max
glyphosate levels (g/L)				
stated on bottle	425	59	356	500
acid equivalent	376	40	356	489
price				
CFAF/liter	3,830	985	2,500	8,000
USD/liter	\$6.96	\$1.79	\$4.55	\$14.55
date of fabrication	12-Jul-15	377	1-Feb-09	24-Dec-16

Resulting sample

Figure 5. Glyphosate samples:
same active ingredient, differing contents



Formulation verification testing

- No ISO accredited laboratories in Mali
- Testing in two external laboratories
 - 1 in West Africa, accreditation in process
 - 1 in USA, accredited

Glyphosate concentrations

Category	Sample size	Bottle label information		Conversion ratio		Acid equivalent* (g/L)		
		formulation	g/l	min	max	min	max	best guess
1	31	acid equivalent	360	1	1			360
2	11	acid equivalent	450	1	1			450
3	33	IPA salt	480	1.35	1	356	480	356
4	2	IPA salt 41%	480	1.35	1	356	480	356
5	3	IPA salt	360	1.35	1	267	360	360
6	1	IPA salt	356	1.35	1	264	356	356
7	5	potassium salt**	500	1.23	1	408	500	489
8	9	not indicated	360	1.35	1	267	360	360
9	1	not indicated	450	1.35	1	333	450	450
10	4	not indicated	480	1.35	1	356	480	356
total	100							

Glyphosate concentrations

Category groupings*	Sample size	<u>Active ingredient formulation</u>	<u>g/L</u>	Acid equivalent (g/L)
Group 1	40	IPA salt	480	356
Group 2	43	IPA salt	360	360
Group 3	12	IPA salt	450	450
Group 4	5	potassium salt	500	489
total	100			

Outline

- 1. Quality implications of rapid market growth**
- 2. Sampling of pesticides sold**
- 3. Preliminary testing results**

Preliminary results: lab estimate/bottle

	Correlation coefficients	
	1 share1	2 share2
Estimated glyphosate dosage		
1 share 1 (lab1/bottle)	1.00	
2 share 2 (lab2/bottle)	0.60	1.00
Registration status		
3 cilss	0.43	0.42
4 unregistered	-0.36	-0.35
5 other registration	-0.14	-0.15
Supplier		
6 International R&D firm	0.36	0.33
Production location		
7 Europe	0.25	0.29
8 China	-0.25	-0.32
9 other	0.08	0.12
Retail price		
10 price	0.06	0.03
Manufacturing date		
11 date	0.02	-0.11

Preliminary results

	Share1	Share2
	lab1/bottle	lab2/bottle
Registration		
status		
CILSS	1.18	0.91
none	0.95	0.82
other	0.95	0.81

Preliminary results

	Share1	Share2
	lab1/bottle	lab2/bottle
Registration		
status		
CILSS	1.18	0.91
none	0.95	0.82
other	0.95	0.81

Conclusions – for farmers

1. Unregistered herbicides

- Contain 5-18% less than stated on bottle
- *Farmers should purchase CILSS registered herbicides*

2. Herbicides registered elsewhere (esp. Ghana)

- Contain 5-19% less than stated on bottle
- *Farmers should purchase CILSS registered herbicides*

Conclusions – for CSP

3. Labelling problems

→ Labels fail to clearly indicate dosage of active ingredients.

4. Lab measurement differences

→ *Region needs to invest in laboratory equipment, accreditation, staffing, quality control practices and funding.*

For More Information, Please Visit

<http://foodsecuritypolicy.msu.edu/>





www.feedthefuture.gov