Natural Resource Management and Fertilizer Complementarities

Theory and Practice

by

Valerie Kelly, David Weight,

Mamadou Lamine Sylla, and Marcel Galeba

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Origin of the paper:

MSU fertilizer research on...

- Fertilizer response and profitability
- Fertilizer impacts on soils and crops of SSA

Collaborative work with SG2000 in Mali...

- Farmers' perceptions of technology risk
- Profitability analyses

Rapid appraisal of OHVN NRM program...

- Evaluate production and income and impacts
- How to scale up and improve monitoring

Organization of the presentation

- **Introductory comments on agricultural transformation**

  (Instead of technical evidence for NRM/fertilizer complementarities)

- **Description of SG2000 and OHVN/NRM programs**
- **Presentation of program results and impacts**
- **Lessons from the case studies**
- **Moving forward**

Agricultural Transformation

Why do we want it?

To reduce poverty and hunger

To promote broad-based economic growth

To protect the environment

What are its characteristics ?

- Farmers expand use of science-based inputs.
- Farmers market more of their output.
- Consumers (including farmers) rely more on markets.
- Agriculture becomes more specialized, productive, and profitable.
- Real prices of food decline.
- Agriculture is increasingly integrated into the world economy.

How does it come about ?

From an ongoing stream of technological and institutional changes such as:

- Improved farm technology developed/adopted
- More efficient input/output markets
- Better tax systems
- Infrastructure that lowers transactions costs:

  Roads, communications, markets
- Improved governance

Mali:

A conducive environment for transformation

Market reforms began in early 1980s

Strong and growing market information system

Removal of many trade barriers

Democratization movement began in early 1990s

Devaluation of CFA franc in 1994

SFI research review shows promising technologies

Agricultural value added grew at 4%/yr 1985-99

Growth even faster since 1994.

But all is not rosy

Major structural constraints remain...

transport infrastructure poor

high risks: both production and price

Adoption of improved technologies limited...

35% of farmers produce 60% of value added

28% of farmers responsible for 90% of marketed surplus of maize

Soil degradation high...

25 kg/ha of N and 20 kg/ha of K lost annually

Case Study Zone Characteristics

SG2000	OHVN/NRM
Segou Region	Koulikoro Region
Sudanian zone	Sudanian zone
Rain 700-800mm	Rain 700-1000mm
Moderately productive soils	Moderately productive soils
60% Ferric Luvisol	100 % Ferric Luvisol
20% Lithosol	
120-150 day season	150-180 day season
Millet, sorghum + pulses	Cotton, tobacco, millet, sorghum, maize + pulses
Animal traction used	Animal traction used

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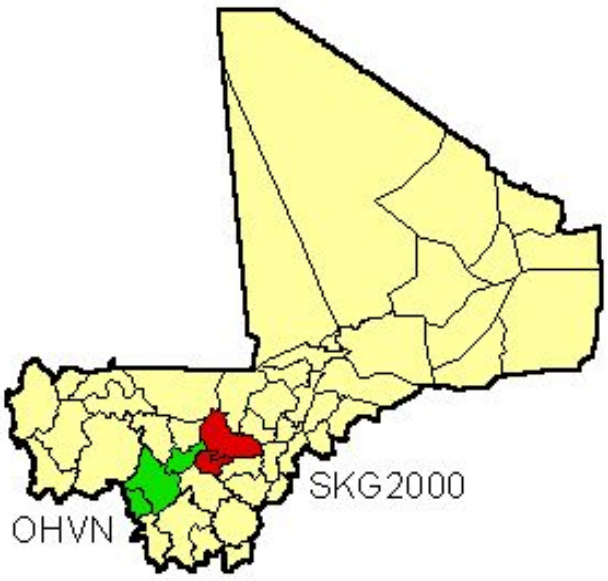

SG 2000 approach

- Exclusive attention to food crops
- Searching for Green Revolution magnitude of changes in productivity
- Focus on soil fertility and improved varieties
- Focus on individual farmers
- Direct farmer participation in technology transfer using test and control plots
- Assist with input delivery and creation of savings and loan associations
- 10-year country program time horizon

Critiques of SG approach

- Too much attention to yield and not enough to profitability
- Adoption frequently not sustainable
- Too much dependence on external inputs vs. alternatives

SG 2000 Mali approach

- Incremental introduction of technologies from low to high costs, risks, and productivity
- Research on farmers' risk perceptions and profitability
- Promotion of savings and loan associations (CREPS)

OHVN/NRM approach

- Support food and commercial crops and livestock BUT require a commercial crop
- Searching incremental, sustainable change
- Focus on increasing incomes *and* conserving water, woodlands, pasture, and soils
- Rural development/community approach using village technical teams
- Major literacy/management training effort
- Promote creation of village associations
- Provide support services/investments
- Long time horizon

Critiques of OHVN approach

- Still in process of transforming from a government parastatal (transferring transport, input distribution, credit activities to others)
- Receives large amounts of donor funding so difficult to know costs

What have the programs accomplished?

Programs and data not comparable

SG – farm survey of participants 3 years into program

OHVN – service statistics and rapid appraisal after more than10 years of NRM activity

SG 2000 – Profitability

Packages recommended:

- Level A - improved seed and fungicide
- Level B – Level A + light fertilization
- Level C – Level A + heavy fertilization

Summary crop budgets: SG

	Level A	Level C
Cases	40	26
Yield change	133	138
Value change	10640 CFA	11031CFA
Pkg cost	1025	7173
Benefit A	9615	3858
Value/Cost	10	1,5

38% of Level C farmers suffered losses; profits for others were in 500-10,000 FCFA range.

Many Farmers suggested elimination of TPR from Level C package.

Perceptions of profitability

- **Level A** – all unanimous that it was highly profitable
- **Level C** –
  - only 11 of 47 farmers thought the package was NOT profitable.
  - Most with losses <5000 CFA thought package was profitable
  - **Why?**
  - Maximizing cereal production rather than income??
  - Doing a whole farm analysis rather than a partial budget??

SG farmers' risk perceptions

Risk factors	Score
poor input access	132
poor rains	116
bird damage	92
declining soil fertility	64

SG technology impact on risk

- **96% claimed SG technologies reduced the risk of crop loss associated with the above mentioned problems**
  - Combination of all inputs worked together to keep yields above normal levels (62%)
  - Fungicide reduced pest attacks (16%)
  - Reduced risk of land access because yields could be increased on existing land (8%)
  - Reduced risk of poor rains (5%)
- **3% claimed risk increased**
  (All were Level C farmers)

SG – Where do they come out?

- Farmers are much happier than the rest of us.
  - Concern about declining effect of fungicide and low absolute yield increase.
  - Concern about credit reimbursement capacity if Level C is not profitable but farmers think it is.
  - Can greater attention to NRM provide better results?

OHVN Results:

Analysis of **aggregate yield statistics** 1991-1998 does not show much growth for OHVN zone:

Crop	Annual Change	Average (kg/ha)
Cotton	**-3% ***	1056
Sor/Mil	+1-2%	998 and 921
Maize/tobacco	no change	1137 and 1722
Rice	+2%	1035
Fonio	**+8% ***	477
Cowpeas	**+52% ***	363

But

NRM adoption continues to grow:

Technique	1991	1996	1999
Rock lines (m)	**1,711**	**79,400**	**101,291**
Gully plugs (m)	2,375	18,500	22,865
Vegetative bands (m)	**426**	**8,998**	**17,579**
Living hedges (m)	**21,305**	**127,022**	**160,162**
Compost/manure pits	1,125	3,571	5,063
Parcellement (ha)	**572**	**1,098**	**3,087**
Parc ameliores	44	146	154
Fire breaks (m)	47	5,250	7,771
Diversionary ditches	**948**	**1,417**	**3,263**

Farm land is being recovered....

34,858 hectares have been restored to normal or superior yield performance from land that had been abandoned or was performing at very low levels.

This represents **17%** of area cultivated in OHVN zone

"Adoption" of NRM is widespread

60% of OHVN villages and **52%** of farms have tried at least 1 NRM technique.

20% of farms have been cultivating the same fields for at least 3 years – i.e., they are maintaining the fertility of their land and not clearing new land.

Yield impacts of NRM/fertilizer: (kg/ha)

	Case study average yields: 6-9 years NRM	OHVN average yields: 1991-1998
Millet	1064	921
Sorghum	1170	998
Maize	1469	1137
Cotton	1327	1056

Partial with vs. without analysis

- Case study of 9 yr. cotton/millet rotation
- NPV of additional production on fields with NRM/fertilizer technologies:
  - 342,320 F high price scenario (456 labor days)
  - 288,560 F low price scenario (385 labor days)

Qualitative indicators of positive income impacts

Life is better now than 10 years ago:

- Food security much less of a problem
- Diets are more varied
- Can buy new clothes more often
- Many riding mobylettes now rather than bikes
- Many have invested in ag equipment/animals
- Men are marrying younger and more often
- Much less out migration now

Key determinants of NRM stimulated productivity and income growth

- ➢Broad range of productive NRM technologies
- ➢Attention to food and commercial crops
- ➢Cotton as a source of stable income
- ➢Community approach to training/implementation
- ➢Focus on youth
- ➢Focus on those most likely to benefit
- ➢Use of demonstration effect
- ➢Incremental training (CLUSA approach)
- ➢Support services (roads, credit, transpt, mkt res.)

Are NRM/fertilizer complementarities stimulating ag transformation?

- There are positive signs:
- Farmers are becoming entrepreneurs and experimenting with new options for increasing incomes.
- Increases in input demand and farm income are stimulating demand for other goods and services.
- Farmers are integrated into world economy.

Although NRM/fertilizer complementarities appear to be stimulating ag transformation in the OHVN more work lies ahead...

- Yields need to go higher

  (SG/OHVN collaboration?)
- Food prices are still to high and volatile
- Risk and uncertainty need to be reduced if farmers are to specialize – the tendency now is toward diversification.

Key adoption lessons:

- The most important ingredients for stimulating adoption of improved technologies are:
  - a profitable *commercial crop* with reliable markets and stable prices
  - a *broad range* of improved, affordable technologies that benefit both commercial and food crops
  - training programs that equip *young* farmers with literacy and management skills needed to function as effective commercial farmers
  - extension services that promote broad *farmer participation* in demonstration plots

Lessons, cont'd...

- The early adopters are not likely to be the most needy, so scaling up remains a major challenge
- Demonstration plots need to be better used to train both farmers and researchers in the basics of profitability assessment for new technologies.

Moving forward...

- Better coordination of soil fertility programs to promote NRM/fertilizer complementarities rather than competition
- Focus NRM/fertilizer extension on zones most likely to succeed
- Focus NRM/fertilizer research on more difficult areas
- Combine ag extension with high quality literacy and management training provided by specialists in this area
- Improve financial analysis of on farm demonstrations
- Improve monitoring of “adoption” and impacts