Effect on yields of priming and of the combination microfertilization & priming compared to control plot (Adama Coulibaly)

Seed Priming and Microfertilization (Mali)

DESCRIPTION

Seed priming and microfertilization are two agronomic measures to increase soil fertility and increase crop harvests in semi-arid drylands.

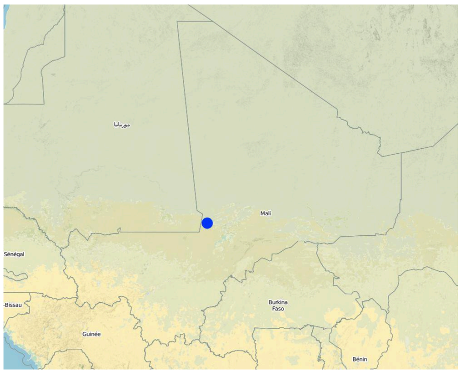
Seed priming consists of soaking seeds for 8 hours prior to sowing and microfertilization is the application of small amounts of mineral fertilizer to the planting hole.

Purpose of the Technology: Seed priming and microfertilization have been found to be effective in increasing pearl millet and sorghum yields under dryland cropping systems. It is also applicable for cowpeas, groundnuts and sesame. Priming will increase the water use efficiency because the seed can start to germinate immediately after sowing. Results from Mali (Koro and Segou) show that yields can be increased by 50 % if microfertilization is combined with seed priming. Other benefits are reduced labour constraints (thanks to simultaneous application) and risk reduction. Seed priming and microfertilization can be practiced independently from each other; however, the combination reduces the risk of crop failure and shows best results in terms of yield increase. Microfertilization has also been mechanised in Mali.

Establishment / maintenance activities and inputs: Seed priming should be carried out after a rain shower sufficient for sowing (15-20 mm) at the beginning of the rainy season. After soaking, the seeds should be air dried for 1 hour prior to sowing (to reduce the stickiness of the seeds and to reduce risk of burning by fertilizer). Fertilizer (NPK 16-16-16; or DAP) is applied at a micro-dose of 0.3 g per planting station, equivalent to 3-8 kg fertilizer/ha, dependent on plant population density. The air-dried seeds and the fertilizer can be applied simultaneously by first mixing the seeds and the fertilizer and thereafter taking a pinch of the mixture between the thumb and the forefinger.

Natural / human environment: The Mopti region is located in the semi-arid Sahel with an average annual rainfall of 400-800 mm during one 3.5 month rainy season. A participatory rural appraisal (PRA) study undertaken in 1999 identified soil fertility as one of the farmers' most serious constraints.

LOCATION



Location: Koro, Mopti Region, Mali

No. of Technology sites analysed:

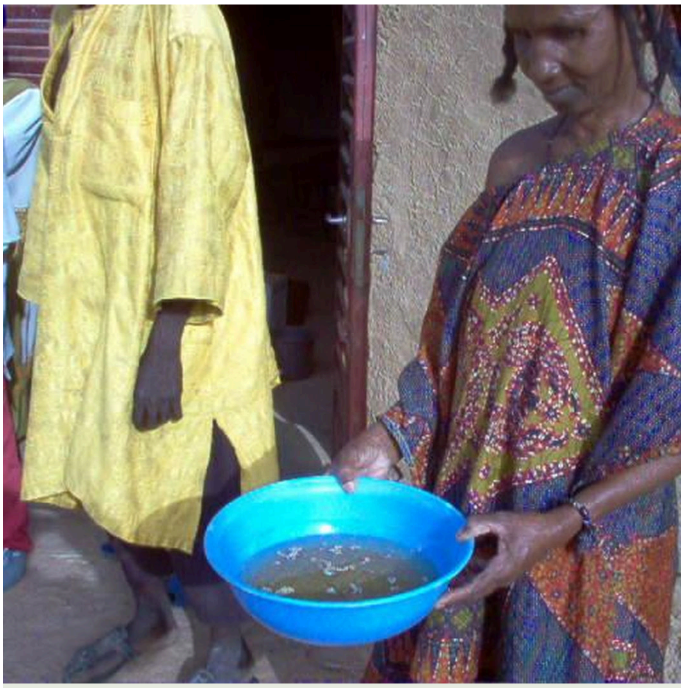
Geo-reference of selected sites
- -5.13553, 15.9155

Spread of the Technology:

In a permanently protected area?:

Date of implementation: less than 10 years ago (recently)

Type of introduction
- ☐ through land users' innovation
- ☐ as part of a traditional system (> 50 years)
- ☑ during experiments/ research
- ☑ through projects/ external interventions



Priming – soaking the seeds for 8 hours (Adama Coulibaly)

Farmers practicing microfertilization with animal traction (Jens B. Aune)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose
- [x] improve production
- [ ] reduce, prevent, restore land degradation
- [ ] conserve ecosystem
- [ ] protect a watershed/ downstream areas – in combination with other Technologies
- [ ] preserve/ improve biodiversity
- [ ] reduce risk of disasters
- [ ] adapt to climate change/ extremes and its impacts
- [ ] mitigate climate change and its impacts
- [x] create beneficial economic impact
- [ ] create beneficial social impact

Land use


Cropland
- Annual cropping

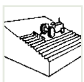
Water supply
- [x] rainfed
- [ ] mixed rainfed-irrigated
- [ ] full irrigation

Purpose related to land degradation
- [ ] prevent land degradation
- [x] reduce land degradation
- [ ] restore/ rehabilitate severely degraded land
- [ ] adapt to land degradation
- [ ] not applicable

Degradation addressed


chemical soil deterioration - Cn: fertility decline and reduced organic matter content (not caused by erosion)

SLM group
- integrated soil fertility management
- Seed priming

SLM measures


agronomic measures - A2: Organic matter/ soil fertility

TECHNICAL DRAWING

Technical specifications

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs
- Costs are calculated:
- Currency used for cost calculation: **CFA**
- Exchange rate (to USD): 1 USD = n.a CFA
- Average wage cost of hired labour per day: 2.00

Most important factors affecting the costs
Fertilizers

Establishment activities
n.a.

Maintenance activities
1. Soak seeds for 8 hours prior to sowing (Timing/ frequency: onset of rainy season, late June)
2. Mix seeds and NPK fertilizer (16-16-16) or DAP at a ratio of 1:1 (Timing/ frequency: before sowing)
3. Sow seeds and fertilizer simultaneously and cover with soil (Timing/ frequency: None)

Maintenance inputs and costs

Specify input	Unit	Quantity	Costs per Unit (CFA)	Total costs per input (CFA)	% of costs borne by land users
Labour					
Labour	ha	1.0	1.0	1.0	
Fertilizers and biocides					
Fertilizer	ha	1.0	2.0	2.0	
Total costs for maintenance of the Technology				**3.0**	
Total costs for maintenance of the Technology in USD				*3.0*	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [x] 501-750 mm
- [ ] 751-1,000 mm
- [ ] 1,001-1,500 mm
- [ ] 1,501-2,000 mm
- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone
- [ ] humid
- [ ] sub-humid
- [x] semi-arid
- [ ] arid

Specifications on climate
500-750 mm (ranked 1, length of dry period: 8 months) as well as 250-500 mm and 750-1000 mm (ranked 2)
Thermal climate class: tropics

Slope
- [x] flat (0-2%)
- [x] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landforms
- [x] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [ ] 0-100 m a.s.l.
- [x] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [ ] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [ ] high (>3%)
- [ ] medium (1-3%)
- [x] low (<1%)

Groundwater table
- [ ] on surface
- [ ] < 5 m
- [ ] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [ ] good
- [ ] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [ ] poor drinking water (treatment required)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Is salinity a problem?
- [ ] Yes
- [ ] No

Occurrence of flooding
- [ ] Yes
- [ ] No

Species diversity
- [ ] high
- [ ] medium
- [ ] low

Habitat diversity
- [ ] high
- [ ] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial)
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [ ] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [ ] poor
- [x] average
- [x] rich
- [ ] very rich

Level of mechanization
- [x] manual work
- [x] animal traction
- [ ] mechanized/ motorized

Sedentary or nomadic
- [ ] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [ ] youth
- [ ] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [x] 2-5 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [x] communal/ village
- [ ] group

Land use rights
- [ ] open access (unorganized)
- [x] communal (organized)
- [ ] leased
- [x] individual

- [x] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

- [ ] individual, not titled
- [ ] individual, titled

Water use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [ ] individual

Access to services and infrastructure

IMPACTS

Socio-economic impacts

Crop production

Crop production	decreased ✓ (6/7) increased	combined effect of seed priming and microfertilisation 50%, seed priming alone 25%
fodder production	decreased ✓ (6/7) increased	increased production of straw
risk of production failure	increased ✓ (5/7) decreased	Risk minimisation: decreased risk of crop failure; and low financial risk in the case of crop failure; seed priming reduces the risk of fertilizer application
expenses on agricultural inputs	increased ✓ (5/7) decreased	Decreased financial resources needed for purchasing fertilizer, makes the technology feasible for poor small-scale farmers
Land productivity	decreased ✓ (5/7) increased	clearance of new land is avoided
Earlier harvest (food security)	decreased ✓ (4/7) increased	

Socio-cultural impacts

Ecological impacts

pest/ disease control	decreased ✓ (5/7) increased	Increased resistance to Striga (pest)
drought impacts	increased ✓ (5/7) decreased	Reduced susceptibility to beginning-of-season droughts; less burning effect if drought after sowing

Off-site impacts

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Benefits compared with maintenance costs

Short-term returns	very negative ✓ (7/7) very positive
Long-term returns	very negative ✓ (7/7) very positive

The technology has a benefit-cost ratio of 10 (increased production value is 10 times higher than the costs for additional fertilizer). Compared to the 6 g microfertilisation method (using Coke caps) cost-benefits ratio of 0.3 g treatment is 8-20 times hi

CLIMATE CHANGE

Gradual climate change

annual temperature increase	not well at all / very well	Answer: not known

Climate-related extremes (disasters)

local rainstorm	not well at all / very well	Answer: not known
local windstorm	not well at all / very well	Answer: not known
drought	not well at all ✓ (4/5) very well	
general (river) flood	not well at all / very well	Answer: not known

Other climate-related consequences

reduced growing period	not well at all / very well	Answer: not known

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology
- [ ] single cases/ experimental
- [ ] 1-10%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?
- [ ] 0-10%
- [ ] 11-50%

- [ ] 11-50%
- [ ] > 50%
- [x] 51-90%
- [ ] 91-100%

Has the Technology been modified recently to adapt to changing conditions?

- [ ] Yes
- [ ] No

To which changing conditions?

- [ ] climatic change/ extremes
- [ ] changing markets
- [ ] labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

Strengths: compiler's or other key resource person's view

- Decreased financial resources needed for purchasing fertilizer, makes the technology feasible for poor small-scale farmers
- No additional labour inputs (the technology does not significantly increase sowing time due to simultaneous application of seeds and fertilizer)
- Adaptability to different land use systems: micro-fertilization can also be mechanised
- None

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

- None

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome

- Dependence partly on availability of mineral fertilizer the technology should be combined with complementary methods for maintenance of soil fertility, such as increased recycling of crop residues as mulch and manure application

REFERENCES

Compiler
Unknown User

Editors

Reviewer
Fabian Ottiger
Alexandra Gavilano

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Resource persons

Jens Aune - SLM specialist

Full description in the WOCAT database

https://qcat.wocat.net/en/wocat/technologies/view/technologies_1328/

Linked SLM data

n.a.

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Project

- Book project: SLM in Practice - Guidelines and Best Practices for Sub-Saharan Africa (SLM in Practice)

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