Delivery basin and energy dissipation structure (Minamba Traore, IICEM)

Lining irrigation canals (马里)

Revêtement des canaux d'irrigation (French)

描述

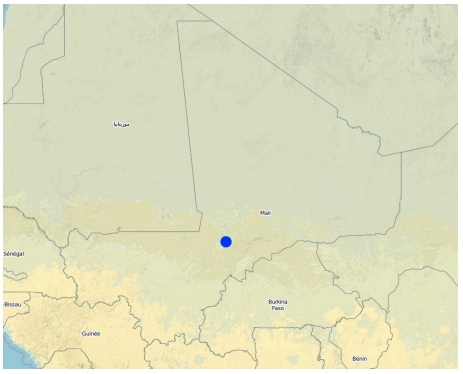
Lining canals is a powerful way to save irrigation water by minimising seepage losses, and to reduce pumping time and costs.

The irrigation area's main earthen canals have their inverts lined in concrete and their sides lined with solid cement blocks. Concrete support posts are set at intervals and capped in concrete. Each lined main canal should be no longer than two kilometres. The main canal's turnouts into the secondary canals are built in cement and are equipped with gates that can be opened and closed as required.
Each turnout's outflow area is protected by a rockfill structure that is built right up to the top of the canal wall to prevent the canal banks at the head of the secondary canals from becoming degraded.

Lining is mainly used to improve the efficiency of existing irrigation systems. Once the canal has been lined, yields increase by between 35% and 80%. This is because crops receive the water they need to ripen as and when it is required. Often, lining also makes it possible to extend the irrigated area. Pumping hours per hectare are considerably reduced (by 25% in the rainy season) because the canals ensure the correct distribution of irrigation water. Consequently, irrigation costs per tonne of produce drop due to the reduction in pumping hours and the costs of periodical maintenance and increases in yields.

Together with the growers, a memorandum of understanding was drawn up with IICEM and then signed by the mayor. The memorandum describes all the activities that form part of the collaboration between IICEM and the various beneficiaries. The works were carried out either in-company or constituted part of the highly labour-intensive work (HLIW).
a) Work delivered in-company (turnkey basis): Works are carried out in several stages: 1) Identifying the sites requiring lining. This involves locating the sites to develop and making contact with the NGOs that represent the project in the region, as well as regional directorates of rural engineering and economic operators working with the farming organisations in question. 2) The delimited sites chosen for development must undergo technical studies, which are entrusted to engineering consultancies recruited through an open tender process in accordance with the terms of reference for the studies to be conducted. 3) The technical feasibility studies comprise topographical, geotechnical, soil and environmental studies, as well as the creation of a development plan and quantification of materials required for the construction work. 4) Drawing up the invitation to tender (ITT) documents and communicating the tender process to businesses. In lieu of a ToR, an ITT is created by the project according to the requirements of the site. It is then published so that interested consultancies can put forward their bids. 5) Works are carried out under the control and supervision of the oversight office to ensure they adhere to professional standards.
b) Highly labour-intensive work: 1) The same as above. 2) Topographical surveys are carried out by IICEM specialists to calculate the calibration of the canals to ensure they are able to submerge plots over a large area. 3) After calibrating the schemes (energy dissipation basin and division box, main canal and secondary canal turnout, channel), a work plan is drawn up. This uses the measurements calculated to quantify construction material and equipment requirements. 4) Teams of (preferably local) builders are recruited to line the canals. The teams comprise master builders, reinforcing ironworkers, bricklayers and surveyors. 5) The materials and equipment required for each site are provided by an appropriate supplier recruited through a tendering process. 6) Provision of labour and farmer participation. Only the building contractors are paid for working on the project. Labour is supplied by the local community who are provided with lunch to maintain motivation and to prevent lost time caused by workers going off-site. 7) In villages where schemes are proposed, teams of shift workers from the local community are set up and trained in proper conduct for working on a canal lining project and in the keeping of a construction project log book.
Once the canal lining works are complete, IICEM provides a pump unit and subsidises the required fuel and consumables for one growing season. Training in how to run and maintain pump units is provided for the local beneficiaries tasked with their upkeep. Furthermore,

地点



地点: Mopti, Timbuktu, Gao, Sikasso, Mali, 马里

分析的技术场所数量:

选定地点的地理参考

- -4.19919, 15.01713

技术传播: 均匀地分布在一个区域 (12.0 km^2)

在永久保护区？:

实施日期: 不到10年前 最近

介绍类型

- ☐ 通过土地使用者的创新
- ☐ 作为传统系统的一部分 > 50 年
- ☐ 在实 /研究期间
- ☑ 通过项目/外部干预

training in the management and maintenance of irrigation schemes is delivered to the farming organisations' steering committee.
The lifespan of a canal lining ranges from 10 to 20 years if small repairs are regularly undertaken. Ensuring linings are impermeable is of the utmost importance because water penetrating through micro-cracks as it flows through the network can lead to rapid and major water loss. It is therefore essential that producers can maintain installations and repair cracks.

The Sahel is a region where the population has always faced a high degree of climate variability, manifested both in terms of time (unexpected dry spells can occur during the rainy season) and in terms of space (rainfall can vary greatly from one area to another). The population is mainly composed of small farmers and livestock keepers.
Over the last two decades, the effects of climate change have exacerbated the already difficult conditions. Accord¬ing to projections made by climatologists, the Sahel will experience a rise in temperatures combined with highly variable rainfall and an increase in extreme weather events.
The Soil and Water conservation and rehabilitation techniques have helped people in the Sahel to manage their ecosystems more effectively and improve their productive land. As a result, communities are better prepared to cope with environmental changes (changes in the climate, land degradation, etc.) and the im¬pact of shocks, particularly droughts

Turnout from a main canal into a secondary canal (Minamba Traore, IICEM)

技术分类

主要目的

- [x] 改良生产
- [ ] 减少、预防、恢复土地退化
- [x] 保护生态系统
  - [ ] 结合其他技术保护流域/下游区域
  - [ ] 保持/提 生物多样性
- [ ] 降低灾害风险
- [ ] 适应气候变化/极端天气及其影响
- [ ] 减缓气候变化及其影响
- [ ] 创造有益的经济影响
- [ ] 创造有益的社会影响

土地利用

同一土地单元内混合使用的土地 是 - 农牧业 包括农牧结合

农田

- 一年一作

每年的生长季节数: 1

牧场

水道、水体、湿地 - 排水管道、水道

供水

- [ ] 雨养
- [x] 混合雨水灌溉
- [ ] 充分灌溉

土地退化相关的目的

- [x] 防止土地退化
- [x] 减少土地退化
- [ ] 修复/恢复严重退化的土地
- [ ] 适应土地退化
- [ ] 不适用

解决的退化问题

土壤水蚀 - Wr 河岸侵蚀

化学性土壤退化 - Cn 肥力下降和有机质含量下降 非侵蚀所致

生物性退化 - Bc 植被覆盖的减少

水质恶化 - Ha 干旱化

SLM组

- 畜牧业和牧场管理
- 灌溉管理 包括供水、排水
- 引水和排水

SLM措施

结构措施 - S3 分级沟渠、渠道、水道

技术图纸

技术规范

The irrigation area's main earthen canals have their inverts lined in concrete and their sides lined with solid cement blocks. Concrete support posts are set at intervals and capped in concrete. Each lined main canal should be no longer than two kilometres. The main canal's turnouts into the secondary canals are built in cement and are equipped with gates that can be opened and closed as required. Each turnout's outflow area is protected by a rockfill structure that is built right up to the top of the canal wall to prevent the canal banks at the head of the secondary canals from becoming degraded.

Technical knowledge required for field staff / advisors: high
Technical knowledge required for land users: low
Main technical functions: water harvesting / increase water supply, water spreading

Author: Minamba Traore, IICEM

技术建立与维护 活动、投入和费用

投入和成本的计算

- 计算的成本为
- 成本计算使用的货币 **CFA Franc**
- 汇率 换算为美元 1 美元 = 512.0 CFA Franc
- 雇用劳工的每日平均工资成本 不适用

影响成本的最重要因素

Around 50 sites covering approximately 1,200 hectares have had their canals lined. Total costs: 1,587,865.50 US Dollar

技术建立活动

1. Identifying the sites requiring lining (时间/频率: None)
2. Launching the invitation to tender for the technical studies / Undertaking topographical surveys to calibrate schemes (时间/频率: None)
3. Performing the technical studies / Quantifying building material requirements (时间/频率: None)
4. Drawing up the invitation to tender (ITT) documents and communicating the tender process to businesses / Recruitment of masons, bricklayers and reinforcing ironworkers (时间/频率: None)
5. Delivery of works under the supervision of the oversight office / Invitation to tender for the provision of materials and equipment (时间/频率: None)
6. Provision of labour and farmer participation (时间/频率: None)
7. Training workers from the local community in building site conduct (时间/频率: None)

技术维护活动

1. small repairs are regularly undertaken (时间/频率: None)

自然环境

年平均降雨量

- [ ] < 250毫米
- [ ] 251-500毫米
- [ ] 501-750毫米
- [x] 751-1,000毫米
- [ ] 1,001-1,500毫米
- [ ] 1,501-2,000毫米
- [ ] 2,001-3,000毫米
- [ ] 3,001-4,000毫米
- [ ] > 4,000毫米

农业气候带

- [ ] 潮湿的
- [ ] 半湿润
- [x] 半干旱
- [ ] 干旱

关于气候的规范

不适用

斜坡

- [x] 水平 0-2%
- [ ] 缓降 3-5%
- [ ] 平缓 6-10%
- [ ] 滚坡 11-15%
- [ ] 崎岖 16-30%
- [ ] 陡峭 31-60%
- [ ] 非常陡峭 >60%

地形

- [x] 平原
- [ ] 山脊
- [ ] 山坡
- [ ] 山地斜坡
- [ ] 坡
- [x] 谷底

海拔

- [ ] 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.

.....应用的技术

- [ ] 凸形情况
- [ ] 凹陷情况
- [ ] 不相关

- [ ] > 4,000 m a.s.l.

土壤深度
- [ ] 非常浅（0-20厘米）
- [ ] 浅（21-50厘米）
- [x] 中等深度（51-80厘米）
- [ ] 深（81-120厘米）
- [ ] 非常深（> 120厘米）

土壤质地（表土）
- [ ] 粗粒/轻质（砂质）
- [x] 中粒（壤土、粉土）
- [x] 细粒/重质（粘土）

土壤质地（地表以下>20厘米）
- [ ] 粗粒/轻质（砂质）
- [ ] 中粒（壤土、粉土）
- [ ] 细粒/重质（粘土）

表土有机质含量
- [ ] 高（>3%）
- [x] 中（1-3%）
- [x] 低（<1%）

地下水位
- [ ] 表面上
- [ ] < 5米
- [x] 5-50米
- [ ] > 50米

地表水的可用性
- [ ] 过量
- [ ] 好
- [x] 中等
- [ ] 匮乏/没有

水质（未处理）
- [ ] 良好饮用水
- [ ] 不良饮用水（需要处理）
- [x] 仅供农业使用（灌溉）
- [ ] 不可用

水质请参考

盐度是个问题吗？
- [ ] 是
- [ ] 否

洪水发生
- [ ] 是
- [ ] 否

物种多样性
- [ ] 高
- [x] 中等
- [ ] 低

栖息地多样性
- [ ] 高
- [ ] 中等
- [ ] 低

应用该技术的土地使用者的特征

市场定位
- [ ] 生计（自给）
- [x] 混合（生计+商业）
- [ ] 商业/市场

非农收入
- [ ] 低于全部收入的10%
- [x] 收入的10-50%
- [ ] > 收入的50%

相对财富水平
- [ ] 非常贫瘠
- [x] 贫瘠
- [x] 平均水平
- [ ] 丰富
- [ ] 非常丰富

机械化水平
- [x] 手工作业
- [ ] 畜力牵引
- [ ] 机械化/电动

定栖或游牧
- [x] 定栖的
- [ ] 半游牧的
- [ ] 游牧的

个人或集体
- [ ] 个人/家庭
- [ ] 团体/社区
- [ ] 合作社
- [ ] 员工（公司、政府）

性别
- [ ] 女人
- [x] 男人

年龄
- [ ] 儿童
- [ ] 青年人
- [ ] 中年人
- [ ] 老年人

每户使用面积
- [ ] < 0.5 公顷
- [ ] 0.5-1 公顷
- [ ] 1-2 公顷
- [x] 2-5公顷
- [ ] 5-15公顷
- [ ] 15-50公顷
- [ ] 50-100公顷
- [ ] 100-500公顷
- [ ] 500-1,000公顷
- [ ] 1,000-10,000公顷
- [ ] > 10,000公顷

规模
- [x] 小规模的
- [ ] 中等规模的
- [ ] 大规模的

土地所有权
- [ ] 州
- [ ] 公司
- [ ] 社区/村庄
- [ ] 团体
- [ ] 个人（未命名）
- [ ] 个人（有命名）

土地使用权
- [ ] 自由进入（无组织）
- [ ] 社区（有组织）
- [ ] 租赁
- [ ] 个人

用水权
- [ ] 自由进入（无组织）
- [ ] 社区（有组织）
- [ ] 租赁
- [ ] 个人

进入服务和基础设施的通道

健康	贫瘠 ✓	好
教育	贫瘠 ✓	好
技术援助	贫瘠 ✓	好
就业（例如非农）	贫瘠 ✓	好
市场	贫瘠 ✓	好
能源	贫瘠 ✓	好
道路和交通	贫瘠 ✓	好
饮用水和卫生设施	贫瘠 ✓	好
金融服务	贫瘠 ✓	好

影响

社会经济影响

作物生产	降低	✓ 增加
生产故障风险	增加	✓ 降低
生产区域（耕种使用中的新土地）	降低	✓ 增加
工作量	增加 ✓	降低

社会文化影响

食品安全/自给自足	减少	✓ 改良
冲突缓解	恶化	✓ 改良

生态影响

水量	降低	✓ 增加

水的回收/收集 径流、露水、雪等 减少 ✓ 改良

场外影响

旱季稳定可靠的水流 包括低流量 减少 ✓ 增加
地下水/河流污染 增加 ✓ 减少
风力搬运沉积物 增加 ✓ 减少

成本效益分析

与技术建立成本相比的效益

短期回报 非常消极 ✓ 非常积极
长期回报 非常消极 ✓ 非常积极

与技术维护成本相比的效益

短期回报 非常消极 ✓ 非常积极
长期回报 非常消极 ✓ 非常积极

气候变化

渐变气候

年温度 增加 非常不好 ✓ 非常好

气候有关的极端情况（灾害）

局地暴雨 非常不好 ✓ 非常好
局地风暴 非常不好 ✓ 非常好
干旱 非常不好 ✓ 非常好
比较和缓的 河道 洪水 非常不好 ✓ 非常好

其他气候相关的后果

缩短生长期 非常不好 非常好 答案 未知

采用和适应

采用该技术的地区内土地使用者的百分比

- 单例/实
- 1-10%
- 11-50%
- > 50%

在所有采用这种技术的人当中，有多少人在没有获得物质奖励的情况下采用了这种技术?

- 0-10%
- 11-50%
- 51-90%
- 91-100%

最近是否对该技术进行了修改以适应不断变化的条件？

- 是
- 否

什么样的变化条件？

- 气候变化/极端气候
- 不断变化的市场
- 劳动力可用性 例如 由于迁移

结论和吸取的教训

长处: 土地使用者的观点

长处: 编制者或其他关键资源人员的观点

- Lining canals is a powerful way to save irrigation water by minimising seepage losses.
- Pumping time and costs are also greatly reduced through the speedy distribution of irrigation water supplies, and reducing the use of motorised pumps lowers maintenance costs.
- Yields increase by between 35% and 80%. Often, lining also makes it possible to extend the irrigated area.
- Training in how to run and maintain pump units is provided for the local beneficiaries tasked with their upkeep. Furthermore, training in the management and maintenance of irrigation schemes is delivered to the farming organisations' steering committee
- The lifespan of a canal lining ranges from 10 to 20 years

弱点/缺点/风险: 土地使用者的观点如何克服

弱点/缺点/风险: 编制者或其他关键资源人员的观点如何克服

参考文献

编制者
Dieter Nill

Editors

审查者
Deborah Niggli
Alexandra Gavilano

实施日期: Sept. 24, 2014

上次更新: May 28, 2019

资源人
Dieter Nill - SLM专业人员
Minamba Traore - SLM专业人员

WOCAT数据库中的完整描述
https://qcat.wocat.net/zh/wocat/technologies/view/technologies_1651/

链接的SLM数据
不适用

文件编制者

机构
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH (GIZ) - 德国

项目
- Manual of Good Practices in Small Scale Irrigation in the Sahel (GIZ)

主要参考文献

- Manual of Good Practices in Small Scale Irrigation in the Sahel. Experiences from Mali. Published by GIZ in 2014.: http://star-www.giz.de/starweb/giz/pub/servlet.starweb
- www.iicem.net: