



CRAFT

Climate Resilient Value Chains
for Improved Livelihoods



Best-Proven Practices and Lessons on Climate-Smart Agriculture (CSA) for Soybean Farming

Climate change presents formidable challenges to agricultural production, especially for small-scale farmers who depend on consistent weather patterns. In Uganda, the cultivation of soybeans is gaining prominence due to its contribution to protein, oil, and animal feed production. Nonetheless, unpredictable weather, soil degradation, and the emergence of pests and diseases associated with climate change threaten to diminish soybean yields. Climate-Smart Agriculture (CSA) offers a strategy for adapting to these challenges, thereby enhancing the resilience, productivity, and sustainability of soybean cultivation. To bolster the soybean value chain, CRAFT interventions were introduced in Mbale, Mubende and Lira districts. This document outlines some of the most effective CSA practices and key insights gained from these interventions, aimed at assisting smallholder farmers in maximizing productivity while mitigating the impacts of climate change.

Best-Proven Climate-Smart Agriculture Practices for Sunflower Farming

Use of Drought-Resistant Soybean Varieties

Climate change is causing longer dry spells, particularly in Uganda's northern and eastern regions, affecting rain-fed crops such as soybeans. The introduction and use of drought-tolerant soybean varieties like Maksoy 3N and Maksoy 6N has proven to be one of the most effective ways to reduce the effects of climate variability while increasing yield.

Best Practice: Farmers should use drought-resistant soybean varieties like Maksoy 3N and Maksoy 6N. These varieties are not only drought resistant, but they also mature faster, reducing their exposure to adverse weather conditions.

Key Lesson: Drought-tolerant varieties have been shown to significantly boost yields in areas with low and irregular rainfall. However, it is important to obtain seeds from reputable suppliers to ensure quality and authenticity. For example, Maksoy 3N an improved variety grown on half an acre gained a gross profit of 31%, whereas the home-saved seed gained a gross profit of 26%.

Improved soil fertility management

Soil degradation is a major impediment to soybean production, particularly in areas where farmers lack access to organic fertilizers and modern soil management practices. Soil health is critical to increasing soybean productivity.

Best Practice: Integrated Soil Fertility Management (ISFM), which combines organic and inorganic fertilizers, crop rotations, and the use of nitrogen-fixing leguminous cover crops (such as cowpeas and groundnuts), is a highly effective method for maintaining soil fertility and increasing soybean yield. Also important is conducting soil testing and the use of rhizobia by farming communities.

Key Lesson: Farmers who use organic matter such as compost, animal manure, and crop residues in conjunction with appropriate mineral fertilizers see improved soybean growth and resilience. Regular soil testing allows farmers to tailor fertilization to their soil's specific needs and reduce unnecessary costs.

Water Management and Irrigation

Soybean farmers face a variety of climate challenges, including irregular rainfall, long dry spells, and flooding. Efficient water management practices, such as digging canals to trap water in farms, rainwater harvesting, and small-scale irrigation systems, can help to mitigate these impacts.

Best Practice: Digging trenches in the garden and rainwater harvesting (for example, using tanks and ponds) provide a consistent water source during dry spells, reducing reliance on rainfall alone.

Key Lesson: Smallholder farmers can successfully implement affordable irrigation systems using locally available materials; however, effective water management must be combined with the adoption of water-efficient crop varieties to ensure sustainability.

Pest and Disease Management

Climate change is accelerating the spread of pests and diseases in soybean farming. Warmer temperatures and unpredictable rainfall patterns promote the spread of pests such as soybean rust, aphids, and stem borers.

Best Practice: Farmers can effectively manage pest and disease pressures by implementing Integrated Pest Management (IPM) strategies such as using resistant varieties, planting on time, and using biological control agents. Regular monitoring and the use of biological control methods (for example, the introduction of natural predators such as bats that prey on insects at night) can help to reduce the use of chemical pesticides.

Key Lesson: IPM lowers pesticide costs and environmental impact while effectively managing pest outbreaks. Educating farmers on early pest detection and prevention techniques is critical to successful implementation.

Diversification and Agroforestry

Climate-Smart Agriculture encourages diversification to reduce risk and increase resilience. Soybean farmers can benefit from diversifying their crops and integrating trees into their farming systems.

Best Practice: Farmers should practice agroforestry, where they grow soybeans alongside trees such as Cassia, Gliricidia, and Calliandra, which help restore soil nutrients, prevent erosion, and provide additional income streams through timber or firewood., which help restore soil nutrients, prevent erosion, and provide additional income streams through timber or firewood.

Key Lesson: Diversification helps farmers buffer against climatic shocks and market price fluctuations, while agroforestry promotes sustainable land use and enhances farm biodiversity.

Lessons Learned from Successful CSA Adoption in Soybean Farming

Farmer-Driven Innovation

Farmers who actively collaborate with local extension services and farmer cooperatives are more likely to successfully implement CSA practices. Peer-to-peer knowledge exchange and practical demonstrations (such as field days) increase the adoption of Climate-Smart Agriculture technologies. Farmers who join local farmer groups or cooperatives, which provide access to knowledge, markets, and resources, are frequently the driving force behind successful CSA adoption.

Training and Capacity Building

Continuous training and capacity building for farmers in CSA practices, crop management, and new technologies is critical for success. Smallholder farmers have gained practical knowledge through exposure to demonstration farms, farmer field exchange visits, organized field days, and workshops led by local agricultural companies or non-governmental organizations (NGOs) such as SNV. Continuous training, particularly in the use of CSA technologies such as improved seed varieties, soil health practices, and water management, greatly improves farmers' ability to adapt to climate change.

Effective Extension Services

Extension services play an important role in spreading CSA knowledge. However, challenges such as a lack of trained extension agents, access due to poor road conditions, inadequate infrastructure, and limited resources have hampered their effectiveness. Collaboration with the private sector (e.g., input suppliers, community structures like village enterprise agents or TOTs, and local market facilitators can help improve the reach and efficiency of extension services by pooling expertise, resources, and market connections.

Access to Financing

The high initial cost of CSA technologies such as irrigation systems, improved seeds, and inputs can impede adoption. Microcredit and insurance products designed specifically for smallholder farmers can help them overcome financial constraints. Increasing access to low-interest loans, grants, and insurance products aimed at climate-resilient agriculture is critical for encouraging farmers to invest in CSA practices.



Gross Profit gained on Home Saved Seed on half an acre



Gross Profit gained on Masksoy 3N improved variety on half an acre

Conclusion

Soybean farming in Uganda has a lot of potential to benefit from Climate-Smart Agriculture practices, which can help smallholder farmers cope with the effects of climate change while also increasing productivity and income. Drought-resistant varieties, integrated soil fertility management, water efficiency, pest and disease management, and diversification are all important CSA practices for soybean farmers.

The lessons learned from successful CSA adoption by farmers demonstrate that farmer-led innovation, capacity building, collaborative partnerships, and access to finance are critical components for scaling up these practices. By providing smallholder farmers with the necessary knowledge, tools, and resources, the CRAFT project ensures a sustainable, climate-resilient future for Uganda's soybean farming communities.

Key Recommendations:

1. Promote research and development of drought-resistant and high-yielding soybean varieties.
2. Improve extension services by connecting farmers with relevant CSA knowledge and resources.
3. Provide access to affordable financing for farmers to purchase Climate-Smart Agriculture technologies and inputs.
4. Encourage peer-to-peer learning and farmer groups to foster knowledge sharing and collective action.
5. Encourage public-private partnerships to enhance market access and ensure sustainable input supply.

Smallholder soybean farmers will be more resilient to climate change and contribute more to national food security and economic growth if these best-proven CSA practices continue to be supported.





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Best-Proven Practices and Lessons on Climate-Smart Agriculture (CSA) for Potato Farming

Potato farming is an important agricultural activity in Uganda, particularly in the highlands of the country's central, western, and southwestern regions. CRAFT interventions were implemented in Kisoro District by the Kisoro District Potato Growers Cooperative Union Ltd to improve the potato value chain. Potatoes are a staple and valuable cash crop that contributes to food security, household incomes, and rural livelihoods. However, climate change has created new challenges such as erratic rainfall, extended dry periods, increased pest and disease pressure, and fluctuating temperatures, all of which harm potato yields and quality. Climate-Smart Agriculture (CSA) provides solutions to help farmers overcome these challenges, adapt to changing climate conditions, and increase the sustainability and productivity of potato farming. Below are outlines of the best-proven CSA practices for potato farming and key lessons learned to help farmers improve their resilience to climate change while boosting productivity.

Best-Proven Climate-Smart Agriculture (CSA) Practices for Potato Farming

Use of Drought-Tolerant and Climate-Resilient Potato Varieties

Potatoes are sensitive to water stress, leading to low yields and poor-quality tubers. With climate change causing more frequent droughts, choosing the right varieties is critical.

Best Practice: Choose drought-tolerant and disease-resistant potato varieties like Taurus, which thrive in water-limited environments and are resistant to common diseases like late blight.

Key Lesson: Climate-resilient varieties increase yields while reducing the need for external inputs such as fertilizers and pesticides, saving farmers money. For example, the Rwangume potato and Taurus improved potato variety grown on half an acre gained a gross profit margin of 36% and 35%, respectively, whereas the Home Saved Seed potato gained a gross profit margin of 29%.



Gross Profit Margin gained on Home Saved Seed on half an acre



Gross Profit Margin gained on the improved variety Rwangume Potato



Gross Profit Margin gained on Taurus Potato grown on half an acre

Integrated Soil Fertility Management (ISFM)

Potatoes need fertile, well-drained soil to thrive. Soil fertility depletion, particularly in areas with continuous potato cultivation, can reduce yields. Climate-Smart Agriculture soil fertility management practices contribute to increased productivity and soil health.

Best Practice: Integrated Soil Fertility Management (ISFM) involves using organic fertilizers (compost and farm yard/animal manure), crop rotation, and a balanced application of mineral fertilizers. Growing legumes (e.g. climbing beans in Kisoro) as part of crop rotation also helps fix nitrogen in the soil, which improves soil fertility for potato production.

Key Lesson: Farmers who use ISFM report improved soil quality, higher yields, and less reliance on chemical fertilizers. Regular soil testing ensures that the proper nutrient balance is used to keep the soil healthy.



Efficient Water Management and Irrigation

Potatoes are very sensitive to water stress, especially during tuber formation. Farmers struggle to rely solely on natural rainfall due to erratic rainfall patterns.

Best Practice: Digging trenches and ridges in the garden and harvesting rainwater are highly effective ways to manage water during droughts. Drip irrigation ensures that water is efficiently delivered directly to the root zone, reducing water waste while improving crop health. Rainwater harvesting systems, such as rainwater tanks or ponds, help to store water for later use during droughts.

Key Lesson: Smallholder farmers who use rainwater can maintain consistent potato yields even in areas with low rainfall. However, the high initial setup cost can be prohibitive for many farmers, so access to affordable financing is critical.

Pest and Disease Management

Climate change has exacerbated the prevalence of pests and diseases in potato farming. Warmer temperatures and changes in rainfall patterns promote the spread of pests such as aphids, potato tuber moths, and late blight.

Best Practice: Use Integrated Pest Management (IPM) strategies that include resistant potato varieties, cultural practices (such as proper crop spacing), and organic pesticides. Fungicides can be sprayed on time to control late blight, while natural predators can help control aphids and other pests.

Key Lesson: IPM reduces the need for chemical pesticides, lowers costs, and minimizes environmental impact. Educating farmers on early disease detection and proper pest management techniques is critical to their success.

Crop Rotation and Diversification

Crop rotation and diversification help to reduce pest and disease spread, improve soil fertility, and mitigate the risks associated with climate variability.

Best Practice: To improve soil fertility and break pest cycles, farmers should incorporate legumes like beans, peas, and groundnuts into their crop rotation systems. Intercropping potatoes with other compatible crops, such as maize or sunflower, can reduce the risk of total crop failure caused by climate shocks.

Key Lessons: Crop diversification and rotation can help manage soil health and pest pressures, making potato farming more resilient to climate change.

CSA Practices on Post-Harvest Handling

Post-harvest losses due to poor handling, storage, and transportation are common in potato farming. Effective post-harvest management is critical to ensuring crop quality and profitability.

Best Practice: Improved storage facilities, such as cool storage rooms or climate-controlled warehouses, help to preserve potato quality and reduce losses due to sprouting or rot. Additionally, solar dryers can be used to dry potatoes, particularly in areas with excess production, extending shelf life and reducing waste.

Key Lesson: Proper storage and handling techniques can significantly reduce post-harvest losses while increasing farmer profitability. Farmers should be trained on how to store potatoes in optimal conditions so that they retain their quality until market access is available.

Lessons Learned from Successful CSA Adoption in Potato Farming

Importance of Training and Knowledge Transfer

Continuous training and knowledge transfer to farmers is essential for the successful implementation of CSA practices. Farmers who have received CSA training have reported increased yield stability and overall resilience to climate variability. Farmer field days and demonstration plots are effective ways to introduce CSA practices. When farmers can see CSA practices in action, they are more likely to adopt them.

Role of Extension Services and Farmer Groups

Extension services and farmer groups play an important role in spreading CSA practices. Smallholder farmers who belong to farmer groups or cooperatives benefit from shared knowledge, resources, and group training opportunities. Farmer groups provide a platform for knowledge exchange, allowing members to share experiences, troubleshoot problems, and access shared resources. Strengthening these groups and ensuring that extension services are available is critical to CSA adoption.

Access to CSA Inputs and Technologies

While CSA practices can significantly increase yields and resilience, they frequently require access to high-quality inputs like drought-resistant potato seeds, irrigation systems, and fertilizers. Many smallholder farmers face significant challenges with low-cost, high-quality inputs. Public-private partnerships that provide farmers with Climate-Smart Agriculture inputs, such as subsidized irrigation kits or high-quality seed varieties, have been successful in increasing CSA adoption. Farmers rely heavily on financial institutions that provide low-interest loans or grants.



The Need for Climate-Resilient Infrastructure

Investing in climate-resilient infrastructure, such as irrigation systems, storage facilities, and climate-controlled warehouses, is critical to increasing resilience and lowering post-harvest losses. Farmers who have access to Climate-Smart Agriculture infrastructure, such as rainwater harvesting systems and solar-powered storage, report lower water stress and losses, particularly during dry seasons.

Conclusion

Climate-Smart Agriculture (CSA) practices are critical to improving the resilience, productivity, and sustainability of potato farming in the Kisoro district. Best practices such as using drought-tolerant potato varieties, efficient water management systems, integrated soil fertility management, and effective pest and disease management can assist farmers in dealing with the challenges posed by climate change. By promoting farmer education, access to Climate-Smart Agriculture inputs, post-harvest handling techniques, and strong partnerships, Uganda's potato farmers can boost productivity, reduce risks, and ensure a stable and sustainable potato supply in the face of climate change.

Key Recommendations:

1. Encourage the use of climate-resilient potato varieties to increase yields and mitigate climate risks.
2. Enhance extension and farmer training programs to promote awareness and adoption of CSA practices.
3. Enhance access to Climate-Smart Agriculture practices and technologies, including quality seeds, irrigation systems, and soil conservation.
4. Promote crop rotation and diversification to enhance soil health and prevent pests and diseases.
5. Improve post-harvest infrastructure to reduce losses and increase market access for potato farmers.

Potato farmers in Kisoro district can improve their resilience to climate change and ensure a sustainable and profitable farming future by implementing these well-proven CSA practices.



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Best-Proven Practices and Lessons on Climate-Smart Agriculture (CSA) for Sunflower Farming

Growing sunflowers is a crucial farming activity in Uganda, especially in the northeast and western areas, where it plays a key role in ensuring food availability, creating income, and producing oil for consumption. Farmers of sunflowers encounter major challenges related to the climate, including unpredictable rainfall, dry spells, erosion of soil, and the spread of pests and diseases. Climate-resilient farming (CSA) tackles these problems by encouraging methods that boost productivity, resilience, and sustainability. The CRAFT project interventions were carried out in the Bukedea and Kapchowra districts to enhance the sunflower value chain. This document will detail the most effective CSA techniques for sunflower cultivation, along with important insights learned to help small-scale farmers adapt to climate change and enhance the long-term viability of their agricultural practices.

Best-Proven Climate-Smart Agriculture Practices for Sunflower Farming

Adoption of Drought-Tolerant and Heat-Resistant Varieties

Climate change has increased the frequency and severity of droughts, as well as higher temperatures, all of which harm sunflower growth. Drought-tolerant and heat-resistant sunflower varieties can help farmers overcome these challenges.

Best Practice: Farmers should use improved sunflower varieties that are bred to be drought and heat-resistant, mature earlier, and withstand prolonged dry spells. Varieties such as SUNFOLA AGSUN, and PANNAR have been shown to produce higher yields while surviving in less-than-ideal moisture conditions.

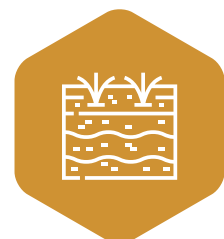
Key Lessons: Early maturing sunflower varieties that are drought-resistant can significantly reduce crop loss during dry spells. To reap these benefits, farmers must first obtain high-quality seeds from reputable suppliers.

Soil Fertility Management and Conservation Agriculture

Sunflower needs fertile, well-drained soil to thrive. Soils in many parts of Uganda have degraded as a result of poor land management practices. Climate-Smart Agriculture soil fertility management practices can help to restore soil health, improve water retention, and increase sunflower yields.

Best Practice: Integrated Soil Fertility Management (ISFM) practices such as organic matter (compost, animal manure), crop rotation, and appropriate inorganic fertilizers can help to maintain soil health and increase sunflower production. Additionally, conservation agriculture practices such as zero tillage and mulching can help protect the soil from erosion and retain moisture.

Key Lesson: Soil fertility management is critical for sunflower productivity. Farmers who incorporate organic matter into their soils report higher sunflower yields and greater resilience to climatic stresses such as droughts.



Efficient Water Management and Irrigation

Sunflower is susceptible to water stress, particularly during flowering and seed formation. Given the increasing unpredictability of rainfall, water management is critical to maintaining sunflower productivity.

Best Practice: Digging trenches in the garden or using rainwater harvesting techniques, such as water storage tanks and ponds, are effective ways to manage water consumption during dry spells. Mulching also helps to retain soil moisture and reduce evaporation.

Key Lesson: Farmers who invest in irrigation systems or rainwater harvesting report higher yields, even in drought-prone regions. However, the initial setup costs can be high, so providing farmers with affordable financing options can boost adoption.

Pest and Disease Management

Climate change has increased the prevalence of pests and diseases that attack sunflower crops. Effective pest and disease management is critical to ensuring healthy crops and high yields.

Best Practice: Integrated Pest Management (IPM) strategies, such as using resistant varieties, crop rotation, proper plant spacing, and biological control (such as natural predators like bats that prey on insects), can aid in the management of sunflower pests such as aphids, caterpillars, and fungal diseases. Pest pressure can also be reduced by planting on time and maintaining plant health through good agronomic practices.

Key Lesson: IPM has been shown to be more cost-effective and environmentally friendly than using only chemical pesticides. Educating farmers on early pest detection and intervention can reduce crop loss and pesticide use.

Agroforestry and Crop Diversification

Agroforestry and crop diversification can help sunflower farming systems be more resilient by providing multiple sources of income, lowering the risk of climatic shocks, and increasing soil fertility.

Best Practice: Agroforestry, which incorporates trees such as gliricidia, leucaena, and cassia into sunflower farms, aids in soil fertility restoration, provides windbreaks, and additional income from timber or firewood. Intercropping sunflower with legumes or other compatible crops (such as beans or maize) can help to increase soil nitrogen levels and reduce pest pressure.

Key Lesson: Agroforestry has numerous advantages, including increased biodiversity, improved soil health, and better water retention. Farmers who use diversification and agroforestry systems typically have more stable incomes and lower risk from market fluctuations and climatic extremes.

Climate-Smart Agriculture Post-Harvest Practices

Post-harvest losses caused by poor handling, storage, and processing can have a negative impact on sunflower farming profitability. Climate-Smart Agriculture post-harvest management ensures that sunflower seeds are properly stored and processed in order to maintain quality.

Best Practice: Storing sunflower seeds in improved storage facilities such as hermetic bags or silos helps to prevent pest and moisture losses. Solar dryers and advanced processing techniques can also help to preserve the quality of sunflower seeds and oil.

Key Lesson: Proper post-harvest management can reduce losses and increase the shelf life of sunflower seeds. This is especially important in areas with limited reliable transportation options.

Lessons Learned from Successful CSA Adoption in Sunflower Farming

Knowledge Sharing and Farmer Training

When farmers are properly trained and informed, they are more likely to adopt CSA practices. Hands-on training, demonstration plots, and exposure to success stories are critical for increasing farmers' understanding and confidence in CSA techniques. Continuous training and knowledge sharing through farmer field days, extension services, and peer learning networks have been critical to the successful scaling of CSA practices. Local farmer groups and cooperatives have been instrumental in spreading these practices.

Strong Partnerships Between Public and Private Sectors

Public-private partnerships (PPPs) have proven effective for scaling CSA technologies. Private companies that supply seeds, fertilizers, and irrigation systems, as well as public institutions that offer extension services, are critical to the adoption of CSA practices. Collaborations between seed companies, agricultural input suppliers, non-governmental organizations (NGOs), and government extension services are critical to ensuring that smallholder farmers have access to affordable and climate-resilient technologies.



Access to Finance and Credit

The initial investment required for adopting some CSA technologies, such as irrigation systems, storage facilities, or drought-resistant seed varieties, can be a barrier for many smallholder farmers. Access to finance and affordable credit can overcome this challenge. Providing microfinance services, agriculture insurance, and Climate-Smart Agriculture loans can encourage more farmers to invest in CSA practices. Partnering with financial institutions to create tailored financial products for smallholder farmers is key to improving adoption rates.

Importance of Long-Term Sustainability

While CSA practices can boost short-term yields, long-term sustainability is also crucial. Farmers must incorporate CSA practices that not only increase productivity but also protect resources for future generations. Water conservation, soil restoration, and pest management are examples of sustainable CSA practices that ensure farming's viability in the face of climate change. Farmers who adopt such practices over time can keep their land productive without depleting resources.

Conclusion

Climate-Smart Agriculture is an important strategy for keeping sunflower farming productive, resilient, and sustainable in Uganda. The best-proven practices highlighted in this guide, such as using drought-resistant sunflower varieties, improving soil fertility, managing water efficiently, implementing integrated pest management, and diversifying farming systems, are critical to mitigating climate change impacts.

Sunflower farmers can increase their CSA practices and resilience to climate change by sharing knowledge, forming partnerships, and gaining access to financing. As the sector expands, stakeholders government, private sector, development organizations, and farmers must collaborate to promote sustainable and Climate-Smart Agriculture farming practices pioneered by the CRAFT project, which will help secure the future of sunflower farming in Uganda.

Key Recommendations:

1. Encourage the adoption of climate-resilient sunflower varieties for better drought tolerance and yield stability.
2. Improve farmer training programs to promote awareness and adoption of CSA practices.
3. Provide affordable financing for smallholder farmers to invest in CSA technologies, such as irrigation systems, silos, and improved seeds.
4. Encourage public-private partnerships to help farmers access resources and expertise.
5. Promote sustainable post-harvest practices to minimize losses and improve market access for sunflower farmers.

By incorporating these CSA practices and lessons, Uganda's sunflower farming sector can thrive despite changing climatic conditions.