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Investment Guide for Community-Based Seed Entrepreneurs in Sorghum Production

Esther Tolorunju, Feyisayo Ayeni, Ronke Adeniyi, Prakash K. Silwal, Olukayode Faleti, Bassey Archibong, Quadri Shakiru, Munir Ahmad, and Sini Luwa

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October, 2023

Published by the International Institute of Tropical Agriculture (IITA), 2023

International address:
IITA, Grosvenor House,
125 High Street
Croydon CR0 9XP, UK

Headquarters:
PMB 5320, Oyo Road
Ibadan, Oyo State

ISBN 978-978-131-416-2

Printed in Nigeria by IITA

Citation: Esther Tolorunju, Feyisayo Ayeni, Ronke Adeniyi, Prakash K. Silwal, Olukayode Faleti,Bassey Archibong, Quadri Shakiru, Munir Ahmad, and Sini Luwa. 2023. Investment Guide for Community-Based Seed Entrepreneurs in Sorghum Production. International Institute of Tropical Agriculture (IITA). 40 pp.

Contents

Appendix

Tables

Foreword and Acknowledgements

This handbook is intended to guide seed farmers, entrepreneurs, agrodealers, extension workers, students of agriculture, and researchers on costs and returns analysis of sorghum seed production in northeast Nigeria.

The guide draws its lessons from the work and experience of IITA and partners in research for the development of seed systems in Nigeria. This publication is a production of the Feed the Future Nigeria Integrated Agriculture Activity implemented in targeted locations of Adamawa, Borno, Gombe, and Yobe states, Nigeria, between July 2019 and December 2024, and was made possible through funding support from the United States Agency for International Development (USAID).

As part of its contribution to the economic recovery process in northeast Nigeria, which the insurgent activities of armed groups have ravaged, USAID awarded the International Institute of Tropical Agriculture (IITA) and its Partners (International Crops Research Institute for the Semi-Arid Tropics and Catholic Relief Services) the five-and-half-year “Feed the Future Nigeria Integrated Agriculture Activity” which aims to advance the objectives of inclusive and sustainable agriculture-led economic growth; strengthened resilience among people and systems; and a well-nourished population, especially among women and children in targeted locations of Adamawa, Borno, Gombe, and Yobe states, northeast Nigeria. The Activity seeks to support vulnerable populations to engage in basic farming activities that will improve food security, increase agricultural incomes, and improve resilience among smallholder farmers and their families. It works with a coalition of partners to facilitate improved agro-inputs and extension advisory services to serve vulnerable populations; strengthens the institutions that form the market system and the networks that serve smallholder

farmers who have been disenfranchised by conflict; and facilitates the engagement of youth and women in economic and entrepreneurial activities.

The team would like to thank the persons noted below, and the facilitators in Adamawa, Borno, Gombe, and Yobe who were responsible for the successful pretesting of the investment guides with selected community-based seed producers and seed companies. In addition, the design and writing of the guides could not have been possible without input from the following individuals: Esther Tolorunju, Environmental and Economic Resource Centre, Feyisayo Ayeni, Environmental and Economic Resource Centre, Ronke Adeniyi, Environmental and Economic Resource Centre, Prakash Silwal, Kayode Faleti, Feed the Future Nigeria, Integrated Agriculture Activity, Bassey Archibong Feed the Future Nigeria, Integrated Agriculture Activity, Quadri Shakiru Feed the Future Nigeria, Integrated Agriculture Activity, Munir Ahmad, Feed the Future Nigeria, Integrated Agriculture Activity and Sini Luwa, Feed the Future Nigeria, Integrated Agriculture Activity.

The Activity would also like to recognize the support and guidance provided by the Management of IITA led by the Director General Dr Simeon Ehui, Dr Alfred Dixon, and others for their continued support of the Activity.

Finally, we thank Dr Ayoade Adetoye, Senior Agriculture Economist and the Activity's Agreement Officer Representative (AOR), and his other colleagues at USAID who have provided their active support in terms of providing technical guidance in making sure we follow USAID rules and regulations and the documents are of quality.

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Acronyms

AC:	Administrative Cost
CBSEs:	Community-Based Seed Entrepreneurs
GP:	Gross Profit
IITA:	International Institute of Tropical Agriculture
IAR:	Institute for Agricultural Research
MoU:	Memorandum of Understanding
NASC:	Nigeria Agricultural Seeds Council
NP:	Net Profit
NIAA:	Nigeria Integrated Agriculture Activity
OC:	Operating Cost
PBD:	Profit before Depreciation
PBT:	Profit before Tax
TC:	Total Cost
TFC:	Total Fixed Cost
TR:	Total Revenue
TVC:	Total Variable Cost
USAID:	United States Agency for International Development

Introduction

Access to improved and quality seed plays a vital role in addressing low agricultural productivity, food insecurity, malnutrition, hunger, and poverty, especially within the context of smallholder farming systems in Nigeria. To achieve this objective, the International Institute for Tropical Agriculture (IITA), through funding support from the United States Agency for International Development (USAID) under the Feed the Future Initiative of the United States Government implements the Nigeria Integrated Agriculture Activity (NIAA). NIAA is a 5-and-half-year Activity that focuses on improving access to quality and improved seeds in the sorghum value chain. The Activity facilitates access to quality and improved sorghum seeds through engagement with community-based seed entrepreneurs (CBSEs). The intervention has led to the establishment of over 2,250 CBSEs with high possibilities of emerging ones, leading to competitiveness in the seed markets.

This handbook is designed to offer some guidance on sound economic decisions to existing and upcoming CBSEs to enable them to compete favorably with other seed producers operating within the sorghum value chains in Northeast Nigeria. The handbook focuses primarily on economic activities on seed production, processing, packaging, and sales. The objective is to present a clear understanding of the cost structure, risks, opportunities, and management decisions that could enhance increased productivity and income for CBSEs in the sorghum value chain. The overall goal is to stimulate investment

in sorghum seed production by presenting information on investment cost implications, operating costs, return on investment, and the expected level of income per production.

The handbook presents detailed cost and returns analysis and brief information on the approach used to arrive at the estimation of the investment model, its usage, and application, as well as its limitations, particularly due to changes in market prices at the time of its development. However, a soft copy of the investment model used for the handbook can be accessed online at……. The soft copy is designed to be updated to ensure its relevance irrespective of time and changes in market prices. The handbook is divided into sections to present clear information and a specific guide on each of the financial models. Details on how the electronic version was used to develop the handbook are presented under the model description.

It is important to note that this handbook is developed in relation to an earlier publication by IITA titled: Guide to Sorghum Production in Northern Nigeria. It is highly recommended that users should first study the handbook to help them understand some of the basic assumptions made on the agronomic practices in this handbook.

Sorghum Seed Production

Sorghum (*Sorghum bicolor* [L.] Moench) is the 5th most important world cereal crop after sorghum, wheat, rice, and barley (FAO 2019). It is a staple food crop in the drier parts of Africa, China, and India (Ajeigbe et al., 2018; Mrema et al., 2017). The largest world sorghum producers are the USA with a total annual grain production of 8.7 million tons from 2.0 million hectares, Nigeria (6.9 million tons and 5.4 million hectares), Ethiopia (5.3 million tons and 1.9 million hectares),

and Sudan (3.7 million tons in 6.8 million hectares) (FAO 2019). The crop is environmentally friendly, requires little or no fertilizers or pesticides, and is biodegradable (FAO, 1995). Nigeria is the leading sorghum producer in Africa, followed by Ethiopia in terms of total production. Sorghum is the largest staple cereal crop, accounting for 50% of the total output and occupying about 45% of the total land area devoted to cereal crop production in Nigeria (FAO 2019).

The crop's economic potential has not been fully realized in Nigeria and sub-Saharan African (SSA) countries due to a number of production and productivity constraints. Lack of high-yielding sorghum varieties, declining soil fertility, drought stress, *Striga* infestation, limited access to production inputs, and credit facility and finance are among the factors accounting for the low sorghum production and product development (Sani et al., 2013). Sorghum research programs in Nigeria have pioneered the development and release of varieties suited to some specific agroecological zones for industrial purposes (Ajeigbe et al., 2018). However, small-scale farmers, who account for over 90% of sorghum production, prefer to use their farm-saved seed of local unimproved varieties due to their intrinsic quality attributes such as good eating quality, adaptation, low insect pest attack, and minimum production input requirements. However, the local landraces have low yield potential, long maturity, and tall plant height and are nonresponsive to improved agronomic management practices (Ajeigbe et al., 2018). Climate-change models show a high probability (> 90%) of an increase in water scarcity and temperature, which will be detrimental to food production in many tropical areas, especially in West Africa (Battisti & Naylor, 2009). Breeding drought-tolerant and climate-resilient sorghum varieties have the potential to offset the yield gap presented by climate change (Fedoroff et al., 2010).

One of the feasible and sustainable ways to address the gap is to promote the adoption of the community-based seed entrepreneur (CBSE) model in the Nigerian seed sector. The CBSE model allows local farmers to act as seed producers, making improved and quality seeds available to smallholder farmers within their local communities at affordable prices. IITA, through funding support from USAID, signed a memorandum of understanding (MoU) with the Nigeria Agricultural Seed Council (NASC) to promote the CBSE approach by ensuring validation and certification of CBSE activities in northeast Nigeria. The approach is growing in northeast Nigeria with the involvement of over 2, 250 CBSEs.

However, considering the youth engagement rate in the seed business alongside the rapid change in weather and economic situations in the country, there is a need to ensure that seed entrepreneurs are properly guided to engage in the business effectively and successfully. In addition, while a series of information has been published on agronomic practices on improved seed, there is no or limited information on economic guidance to enable existing or new CBSEs to make sound economic decisions to ensure the success of their operations. To this end, this handbook intends to offer guidance to community-based seed entrepreneurs (CBSEs) on sound economic and management decisions necessary to ensure sustainable investment in sorghum seed production.

Basic Agronomic Information

Different sorghum varieties come with varying agronomic requirements. According to data obtained from the Nigeria Seed Portal, the following varieties can be grown in the Northern Guinea savanna:

SAMSORG 51SW (Yajin-69 (NRSSS005))

SAMSORG 50SW (Dansadau)

SAMSORG 49 (CF 35:5)
SAMSORG 48 (KAURA BORNU)
SAMSORG 47 (ZAUNA-INUWA)
SAMSORG 46 (12KNICSV-22)
SAMSORG 45 (12KNICSV-188)
MLSH 296 Gold (MLSH 296 Gold)
PD87W16 ()
PD86W15 ()
CSR-04 H ()
CSR-03 H ()
SAMSORG 44 (SSV20043)
SAMSORG 43 (SSV98002)
SAMSORG 42 (SSV98001)
SAMSORG-9 (KSV -15 (L.2281/79))
SAMSORG-8 (KSV -14 (L.2024/79))

SAMSORG-7 (KSV -13 (L.2007/79))
However, for the purpose of this handbook, attention will be centered on the agronomic properties of the commonly cultivated varieties in northeast Nigeria and these include SAMZORG 45, 46, and 48. These varieties are commonly grown among the CBSEs following their early maturing, high-yielding, and moderate micronutrient content. It is important to note that out of the three varieties, SAMZORG 45 is mostly grown. Thus, all agronomic properties adopted for this handbook are based on the SAMZORG 45 variety.

The variety has a production cycle of three 90–100-day cycles, from planting period to harvesting as seeds. This implies that the variety can only be grown at least once a year. It is recommended that sorghum should be sown at an interrow (between rows) spacing of 60 cm and intrarow (within rows)

spacing of 25 to 30 cm. A planting depth of 5 cm is ideal with sufficient moisture. Under drier conditions, the seed should be planted deeper, but no more than 5 cm.

The population is expected to produce a yield of between 2,000 and 2,500 kg per hectare, at an average of two (2) seeds per stand. However, the actual average yield reported by CBSEs is 2,500 kg/ha. This gives an average bag of sorghum per hectare of 25 bags at 100 kg per bag. The yield is the same as the expected bag of sorghum of 25 bags per hectare as estimated in the model. A summary of the production assumptions used for the model is presented in Table 1 below.

Table 1. Basic information on sorghum seed production

Plant information	**Values**
Land length (meter)	100
Land breath (meter)	100
Inter-row spacing (meter)	0.75
Intra-row spacing (meter)	0.25
Number of stands per hole	2
Average weight per bag	100
Land area (meter square)	10,000
Required planting space (area per stand)	0.19
Bags of sorghum seed per hectare (kg/ha) Samsug 45	25

2

Methodological approach

The handbook was developed based on consultations with CBSEs in sorghum production. A series of meetings were held with a total of 140 representatives of the existing seed producers of different production capacities to gain an understanding of their business operations, including the investment and operating costs. The sample size was estimated using a minimum sample size calculator covering about 90% of the population proportion of 2,250 CBSEs at a 95% confidence interval. The aim is to help arrive at a valid cost−benefit analysis to guide new or existing CBSEs. It was observed that the majority of the existing CBSEs operate as a group and share the cost of the fixed assets used for their production, such as tractors, planters, water sources, etc., especially the newly established ones, while a few CBSEs operate individually. As a result, the cost of production varies significantly due to the share of fixed assets costs. However, to ensure that a valid business model was developed irrespective of the mode of operation, a stakeholders' validation meeting was organized to review the business activity and validate each of the cost elements based on existing business operations and market prices.

Considering the variations that exist across CBSE business operations, including the scale of operations and management costs, a generic investment model was developed to accommodate this concern. As a result, the electronic version of the model is designed to be updated to suit the individual CBSE business scales, operations, and management structure. To

arrive at a standard investment guide, an average CBSE business structure and current market prices were used in designing the model. Thus, the estimation presented in this handbook represents standard CBSE business operations and the existing market prices at the time of the production, precisely October 2023. It is important, however, to note that the model can be adjusted to either lower or higher CBSE business operations alongside the market prices. The rationale is to enable any of the existing or upcoming CBSEs to utilize the model irrespective of their scale of operations, locations, and market prices. Thus, the handbook presents brief information on the electronic version of the model that was used to guide CBSEs on how to adjust or update the handbook to meet their respective business operations. This, therefore, implies that figures used for estimation could be regarded as assumptions as the values may change due to several factors, including variation in capital assets, management structure, labor costs, market prices, frequency of sales, utility costs, etc. The discussion presented in the model is based on the final estimation as contained in each of the tables.

The Model Description

The model is designed primarily with Microsoft Excel to facilitate ease of estimation and updating of the model. The Excel has a total of five worksheets, including the index, assumption sheet, depreciation, cost projection, and summary page. Each of the worksheets is named after a specific financial estimation. Of all the worksheets, only the assumption sheet is designed to be edited or updated to accommodate the variations that may exist across different CBSE business operations. All of the sheets are linked such that any adjustment made through the assumption sheet will reflect on the entire model. The assumption sheet has three main forms of cells, each having a different color code, as indicated below.

Table 2. Legend

Name	Color code	Explanations
Calculations		DO NOT CHANGE
Hardcoded assumptions		Can change
To be revalidated		Can change

The table provides a guide to how the electronic version could be updated. The **orange cells** indicate cells in the Excel that should not be touched to avoid disruption in the model. To prevent the possibility of having such disruptions, the real cells are, however, locked. The **blue cells** contain figures based on the average business operation and actual market prices as elicited directly from the CBSEs. However, the cells can be revised based on individual business status. Also, the **yellow cells** represent figures that are assumed based on the current happenings. This is also subject to change based on individual business operations. It should be noted, however, that the figures used in this handbook are a true reflection of the current CBSE business in northeast Nigeria as of October 2023. To adjust the handbook to reflect the current business reality at any point in time, only the blue and the yellow cells should be adjusted.

3

Soybean production cost requirements

To standardize the cost and business operation reported in this handbook, each cost is estimated on a per-hectare basis. This is to allow for ease of extrapolations and scaling. Hence, the model and handbook presents a summary of the cost implications per hectare per production cycle. It also presents different production scenarios. It should be noted that while the yield varies from the estimation, the cost implication recorded under each scenario remains the same. This implies that an intending CBSE needs to work towards attaining the actual yield per hectare reported by the existing CBSEs to maximize income from their production activities to enable him/her to compete favorably.

Observations from the interaction held with farmers revealed that different capital items are owned by different CBSEs. The variation is influenced by a number of factors, including capital, production capacity, management practices, and so on. From the analysis, basic capital assets are required to operate a community-based production, and these include land, storage house, water source, planter, harvester, and basic farm implements such as wheelbarrow, head pan, rake, etc.

From the investment model, an average capital of ₦605,740 will be required to establish a standard community-based sorghum seed business. Based on the model, the average

cost requirement is presented in Table 3. The highest share of the capital is largely dominated by operation costs covering a total of 62.65 percent, followed by fixed cost, which covers 23.94 percent while the administrative expenses cover a token of 11.43 percent of the total capital requirement.

The operative costs include labor costs (planting, weeding, spraying, harvesting, packaging, etc.), herbicides, packaging bags, and so on. On the other hand, the administrative costs include the cost of NASC Inspection and certification, extension services, insurance, fuel costs, repairs, and phone calls, Again, these may vary depending on the aforementioned factors that influence the cost of investment/production.

Table 3. Basic capital and production cost for CBS business

N	**List of Items**	**Cost**	**% Share**
1	Land (rent)	10,000	1.65
2	Building/storehouse (rent)	70,000	11.56
3	Tractor (hire)	20,000	3.30
4	Vehicle (hire)	15,000	2.47
5	Two knapsack sprayers (purchased)	30,000	4.95
6	***Total fixed cost***	*145,000*	*23.94*
7	Total variable cost (Appendix 1)	379,500	62.65
8	Procurement of foundation seed	12,000	1.98
9	**Average administrative expenses (Appendix 1)**	69,240	11.43
10	***Total operating cost (Appendix 1)***	*448,740*	74.08
11	Total cost (line 6 + 8 + 10)	*605,740*	*100.00*

Note: To arrive at an actual cost project per specific business operation, it is advisable to make use of the e-version of the financial model. Refer to Appendix 1 for the Economics of production.

4

Costs and returns analysis

Table 4 presents the summary of the costs and returns analysis per production cycle per hectare. From the proposed actual yield of 2,500 kg/ha, a CBSE is liable to generate a gross profit of ₦1,370,500 per hectare while the expected net profit is ₦1,151,260. This indicates the amount of money a CBSE can re-invest into the business. The net profit indicates the amount of money a CBSE can re-invest into the business.

The analysis suggests that existing and upcoming CBSEs must ensure the recommended yield of 2,500 kg/ha to operate favorably in the seed business. However, farmers who are new to the business should strive not to go below a minimum yield of 2000 kg/ha so as to at least break even. The yield agrees with the average yield reported in sorghum production in the northeast.

Table 4. Costs and returns analysis

Financial summary	Production Performance
Description	SAMSUG 45
Bags of seeds sold per hectare (100-kg bags)	25
Total variable costs (Appendix 1)	379,500
Sales of certified seeds (revenue)	1,750,000
Cost of foundation seeds	12,000
Gross profit	1,370,500
Admin expenses (Appendix 1)	69,240
Profit before depreciation	1,301,260
Shared cost of fixed asset (refer to Table 3)	145,000
Profit before tax	1,156,260
Tax (zero for startup businesses)	5,000
Net profit from production	1,151,260

5

Decision-making in seed production

Considering that the average sorghum yield in northeast Nigeria stands at 2,000 kg/ha per hectare, it is highly recommended that a new CBSE start the operation with just one hectare and later scale up the production after attaining a reasonable yield. This will help to reduce risk in investment while lowering the cost of capital requirement to kick-start the business.

Also, starting the business with basic capital assets, as listed in Table 3, is highly recommended, especially when operating a one-hectare farm. This is to avoid an increase in depreciation costs, which consequently reduces the net profit. In addition, increasing capital assets will lead to an increase in maintenance costs, thus, increasing the overall administrative costs.

Considering that a community-based seed business can be established with an average of ₦605,740, it is recommended that an intending CBSE engages in little or no loan services with a repayment period of at least two years with a maximum interest rate of 10 percent, especially for starters. Under such conditions, it is recommended that the intending CBSE strive to attain a recommended yield of 2,500 kg/ha and not go below 2000 kg/ha by adopting the use of an improved variety. This will enable an intending CBSE to attain a reasonable income level after the first year of production of two production cycles per year. With the increase in the number of new CBSEs, the existing and upcoming seed entrepreneurs should adopt strategic community engagement with farmers to boost demand and sales.

6

Demand market analysis

There is a growing demand for sorghum compared to other grain produce due to sustainability, affordability, unique flavor, and growing demand for gluten-free products.

The product is predominantly used by companies producing beverages, breakfast cereals, and confectionery, and a small percentage of the grain is also used as animal feed, while its stalks are used to build shelters or fences and as livestock feed.

The area under cultivation in northeast Nigeria is about 243,000 hectares of arable land, and the active population of farmers in northeastern Nigeria is estimated to be between 3 and 5 million people (FAO, 2019). There are only 2,250 seed entrepreneurs to produce seeds that will be cultivated by these farmers. And not all 2,250 farmers are into sorghum seed production. Consumption of sorghum is also at an all-time high. According to the National Bureau of Statistics, Nigeria exported N875 million sorghum seeds in the first quarter of 2023. This is an indication that there is a big market for the sale of sorghum grain in Nigeria.

Channels of marketing

In northeast Nigeria, several marketing channels have been identified for the sales of seeds by a CBSE, and these include seed companies, agrodealers, direct engagement with farmers, open markets, and input fairs. Of all the available market channels, the strategic community approach—which implies engagement directly with farmers through the extension agents, has proven to be the most effective market channel. Under this approach, CBSEs engage the services of extension workers to interact and sensitize the farmers on the quality of seeds, prices, location, etc., thus facilitating access to improved and quality seeds to smallholder farmers within their immediate communities.

The other component of the strategic community approach is through the engagement of marketing agents. For effective demand, a CBSE is required to have marketing agents who are able to engage with farmers at all levels, including mosques, churches, and the community level to sensitize farmers and stimulate demand. This approach has been extremely effective in increasing demand for notable agro-dealers and CBSEs in northeast Nigeria.

Factors influencing seed marketing

The seed market is influenced by several factors, including planting, prices, and increased awareness of improved and quality seeds among smallholder farmers. While these factors are highly important in driving demand, logistics remains a critical factor in ensuring that smallholders have access to seeds.

CBSEs were not only required to engage with buyers but must also adopt effective market logistics to be able to meet the demand of farmers. Sometimes, seed buyers come from afar, and reaching such may be a major challenge. One of the proven logistic arrangements in responding to such needs is to work closely with farmers to arrange for a representative who is able to travel the distance to bring seeds to other farmers in the community. This approach is recommended when demand from such communities is relatively low to warrant establishing sales outlets in such communities.

9

Opportunities in the sorghum market

Almost all sorghum traded on international markets is for use as livestock feed. Average world exports of sorghum in 1998−2002 amounted to 6.3 million t/year, almost all from the United States (5.6 million t/year) (Brink & Belay, 2006). The main importers are Mexico and Japan. In tropical Africa, most sorghum is grown for home consumption (except for beer production). In southern and eastern Africa, malting sorghum for beer brewing has developed into a large-scale commercial industry, using about 150,000 tons of sorghum grain annually. In Uganda, commercial production of lager beer using sorghums instead of barley is becoming a great success (the annual requirement of sorghum is 3000 tons) and is very promising for other African countries (Brink and Belay, 2006). In Nigeria, sorghum malting has become a major industry for lager and stout beer brewing and for malt beverages, using 15,000 tons of sorghum annually. In South Africa, an instant breakfast cereal is made from sorghum, which is similar in quality but much cheaper than wheat or sorghum products. Annual production is 12,000 tons and is increasing steadily (Brink & Belay, 2006). In West Africa, small tied bundles of 4−6 leaf sheaths of sorghum dye cultivars are offered for sale on local markets (in the 1990s the price was about 150 CFA). In 1993, in Burkina Faso, the red pigment was successfully extracted chemically from sorghum leaf sheaths and offered for sale as dry powder on the world market (Brink and Belay, 2006).

10

Risk and risk management in the sorghum business

In the sorghum business, as with any agribusiness, there are inherent risks that potential investors should be aware of. These risks can impact the success and profitability of sorghum farming and trade. Understanding and effectively managing these risks are essential to attain maximum profit at the minimum cost possible.

Sorghum crops are vulnerable to a range of pests and diseases, contributing about 56% to loss in sorghum yield. If not managed effectively, pest and disease outbreaks can result in substantial crop losses. Implementing timely and appropriate pest control strategies and utilizing disease-resistant sorghum varieties are essential for risk mitigation. Sorghum prices are subject to fluctuations due to various factors. These may include variations in weather conditions, changes in supply and demand, and even speculative market behavior.

Also, managing the sorghum supply chain presents its own set of challenges. Issues related to transportation, storage, and logistics can lead to postharvest losses, impacting both farmers and businesses. Addressing these supply chain risks is vital for ensuring the quality and availability of sorghum in the market. Seed farmers should ensure they meet the breakeven point in their production regardless of the risks encountered by not going below 2,000 kg/ha of sorghum certified seeds.

Potential investors can adopt various risk management strategies to navigate these risks and create a sustainable and successful sorghum business by conducting thorough market analysis to understand demand trends, consumer preferences, and competitive dynamics. An in-depth understanding of the market can guide investors in making well-informed decisions.

Incorporating modern farming techniques and technology, such as precision agriculture and weather forecasting, can help predict and manage climate-related risks more effectively. Also, implementing robust pest and disease control measures, including crop rotation, integrated pest management, and the use of disease-resistant sorghum varieties, can reduce the threat of pest and disease outbreaks.

To resolve the issue of supply chain management, investing in appropriate storage facilities and transportation infrastructure is essential to minimize postharvest losses. Ensuring that sorghum reach the market in optimal condition is crucial for profitability.

Above all, exploring partnerships with government agencies and non-governmental organizations involved in agriculture and rural development, like IITA, FAO, USAID, etc. can provide valuable support and resources for risk management and sustainable growth.

Summary

The community-based seed business is a profitable venture if all the recommended agronomic and economic principles are obeyed. Irrespective of the variety used, existing or prospective CBSEs must aim to attain the recommended yield of 2,500 kg/ha or, at worst, 2,000 kg/ha. Begin business operation on one hectare with basic capital assets to minimize risk and reduce the cost of investment. Scale after at least the first successful production cycle and ensure the operation of at least two (2) production cycles in a year by adopting of irrigating farming to maximize profit. Above all, efforts must be put in place to ensure the producer−customer relationship to facilitate demand for sales.

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Appendix – I

Table 5. Economics of production

Labor cost	Unit cost (₦)	Qty (Ha/ L/kg)	Freq	Total cost
Land clearing	20,000	1	1	20,000
Land preparation	17,000	1	1	17,000
Planting	20,000	1	1	20,000
Weeding	40,000	1	2	80,000
Spraying	40,000	1	2	40,000
Harvesting/loading	50,000	1	1	50,000
Drivers	0	0	0	0
Pre-emergence herbicide	5,500	2	1	11,000
Post-emergence herbicides	3,500	4	1	14,000
Npk fertilizer	25,000	4	1	100,000
Seed sorter	15000	1	1	15,000
Urea	2,500	2	1	5,000
Packaging bags (100 kg only)	500	15	1	7,500
Total variable cost				**379,500**
Administrative costs	Unit Cost	Quantity	Freq	Total Cost
Documentation and advisory services	3,000	1	1	3,000
NASC inspection and certification	30,000	1	1	30,000
Service providers (F/Mapping)	5,000	1	1	5,000
Extension services	10,000	1	1	10,000
Insurance (2% of variable cost)	7,590	1	1	7,590
Water (for spraying of chemicals etc.) (50 per paint bucket)	230	55	1	12,650
Phone Calls	1,000	1	1	1,000
Total administrative cost				**69,240**
Total operating cost				**448,740**

Appendix – II

Explanation of the cost and returns analysis method

This section explains the cost analysis, i.e., the values of the input used in production, and the returns analysis, i.e. the yields realized in production per hectare. How they are estimated is shown in the table in Appendix I.

1. The Total Fixed Cost (TFC) is the total cost of all physical assets like buildings, land, tractor, rent, etc., sum up all your fixed assets to get the TFC.

2. The Total Variable Cost (TVC): These are expenses incurred on variable inputs like labor cost, seed procurement, cost of fertilizer, seed preparation, and other operating costs. Sum all these costs to get your TVC.

3. Administrative Cost (AC): These are costs incurred by the farmer to support the functioning of his farm that is not directly related to the production of sorghum. It is also known as utility cost. Add all utility costs, like the cost of maintenance or repair of the tractor, water supply, payment of security personnel, telephone communication, etc., together to get (AC).

4. Total Cost (TC): This is the actual cost that must be incurred to produce your sorghum yield. This can be calculated by adding Total Fixed Cost (TFC), Total Variable Cost (TVC) and Administrative Cost (AC).

5. Operating Cost (OC): All expenses the farmer incurs in his day-to-day farm operations during the production cycle are operating costs. Add TVC as explained in (2) and AC as explained in (3) to get OC.

6. Total Revenue (TR): This is the total money the farmer generates from the sales of his sorghum. Multiply the price of 1 kg of sorghum with the total yield realized on the farm (e.g., 2,000 kg/ha) to get the TR.

7. Gross Profit (GP): This is the profit the farmer realizes after deducting all operating costs from his Total Revenue, i.e., TR- OC.

8. Profit before Depreciation (PBD): This is the farmer's profit before deducting depreciation of assets, i.e., Gross profit – Administrative Cost.

9. Profit before Tax (PBT): This is the farmer's profit before deducting Tax. i.e., Profit before Depreciation – Total Fixed Cost.

10. Net Profit (NP): This is the real or actual profit the farmer earned after deducting all operating, interest, and tax expenses during that particular production cycle, i.e., Profit before Tax – Tax.

Appendix – III

Cost and returns analysis method

N	Production Cost	Formula
1	Total Fixed Cost (TFC)	Add the cost of all fixed assets Together, e.g., Land + Tractor cost
2	Total Variable Cost (TVC)	Add all the labor costs and other operating costs together
3	Administrative cost (AC)	Sum up all costs of utilities, e.g., maintenance cost
4	Total Cost (TC)	TFC + TVC + AC
5	Operating Cost (OC)	TVC + AC
6	Total Revenue (TR)	Unit price of 1 kg of sorghum × Total yield (750 × 2500 kg)
7	Gross Profit (GP)	TR – OC
8	Profit before Depreciation (PBD)	GP – AC
9	Profit before Tax (PBT)	PBD– TFC
10	Net Profit (NP)	PBT – Tax

Appendix IV

Farm production record guide

1. Machinery and Equipment Record

	Date	Types of Operation	Machinery or Equipment used	Total Area Covered	Cost of Services
1.	25/06/2023	Planting	Tractor	1 hectare	#40,000
2.	20/09/2023	Harvesting	Harvester	1 hectare	#20,000

2. Labor Record

Week	No of hired labor	No. of family labor	Total No. of labor used	Wage rate	Total cost of hired labor
25/06/2023	3	1	4	#5000 / person	#20,000
28/06/2023	0	2	2	#5000/ person	#10,000
					#30,000

3. Sales Record

S/N	Date	Quantity sold	Price per Unit	Total Sales (Quantity sold × Price per unit)	Quantity given out as a gift
1.	20/09/2023	10 kg	#750	#7,500	1 kg
2.	21/09/2023	30 kg		#22,500	0

Sorghum model

Title:	**Investment Guide For Community-Based Seed Producers**
Filename:	**Sorghum Production**
Date created:	**27/10/2023**

Legend

Name	Colour code	Explanations
Calculations		DO NOT CHANGE
Hardcoded assumptions		Can change
To be revalidated		Can change

Sheet	Explanation
Index	*Table of contents and legend*
Assumptions	*Key input assumptions*
Cost projections	*Details of costs elements*
Financial Summary	*Summary of key financial items*

Key	
Estimated Areas (No need to touch)	
Input Areas (Areas to update)	
Estimated cells (no need to touch)	

	Basic Information	**Response**
A)	Crop Name	Sorghum
	Production Cycle (Months)	3 Months
	Number of Cycle grown in a Year	1
	Number of Varieties Grown	1
	Names of the Commonly Grown Variety	SAMSUG 45
	Differences in Varietal Yield (Yes/No)	Yes
	Name of the Variety Used for the Investment Model	SAMSUG 45

	GENERAL ASSUMPTIONS	Values
B)	**Plot Information**	
	Land Length (meter)	*100*
	Land Breath (meter)	*100*
	Inter-row Spacing (meter)	*0.75*
	Intra-row Spacing (meter)	*0.3*
	Number of Stands Per Hole	*2*
	Average Weight Per Bag	*100*
	Bags of Sorghum Seed Per (Kg/Ha)	*25*
	Land Area (meter square)	*10,000*
	Required Planting Space (Area Per Stand)	*0.19*
	Average Seed Hole Per Land Aread	*53,333*
	Average Number of Sorghum Stands Per Land Area	*106,666.67*

C)	FIXED ASSET (Shared Cost)	Unit Cost	Quantity	Total Cost
	Land (The land was rented on a yearly basis)	10,000	1	10,000
	Tractor (rented per year)	20,000	1	20,000
	Building/Store House (Rent)	70,000	1	70,000
	Vehicle (Hire during Harvesting)	15,000	1	15,000
	Motorised Sprayer	0	0	-
	Knapsack Sprayer	15,000	2	30,000
	Total	130,000		***145,000***

D)	Labour Cost Per Production Per Hecatare Per Cycle	Unit Cost	Quantity	Frequency	Total Cost
	Land Clearing	20,000	1	1	20000
	Land Preparation (Tilling/Ploughing, Harrowing, etc. Raining season)	17,000	1	1	17000
	Planting	20,000	1	1	20,000
	Weeding	40,000	1	2	80,000
	Spraying (if different from weeding)	40,000	1	1	40,000
	Harvesting / Loading/ Packaging	50,000	1	1	50,000
	Drivers (Included in harvesting and loading cost)	0	0	0	-
	Total				**227,000**

E)	**Procurement of Foundation Seeds**	2,000	6	1	12,000

F)	Other Operating Costs	Unit Cost	Quantity	Frequency	Total Cost
	Pre-emergence Herbicides	5,500	2	1	11,000
	Post- emergence Herbicides	3,500	4	1	14,000
	NPK 15:15:15 Fertilizer	25,000	4	1	100,000
	Seed Preparation / Sorters #1000/bag	1,000	15	1	15,000
	Urea	2,500	2	1	5,000
	Packaging Bags (100kg only) Babagana bag	500	15	1	7,500
	Total				**152,500**

G)	Utilities (Per Hectare Per Cycle)	Unit Cost	Quantity	Frequency	Total Cost
	Documentation and Advisory services	3000	1	1	3000
	NASC Inspection and Certification	30,000	1	1	30000
	Service providers (F/Mapping)	5,000	1	1	5000
	Extension Services	10,000	1	1	10000
	Fueling / Transportation	0	0	0	0
	Insurance (2% of Variable Cost)	7,590	1	1	7590
	Water (for spraying of chemicals etc.) (230per paint bucket)	230	55	1	12650
	Phone Calls	1,000	1	1	1000
	Total				**69,240**

			Expected Yield
I)	**Market Information (average price/bag = N70,000)**	**Unit Price/ bag**	**SAMSUG 45**
	Price of Certified Seed(100 kg bag) only	70,000	25
	Price of Certified Seed per kg = **N70**0		
	Total Sales		1,750,000
J)	**Tax Information #200/ bag**	200	5000

Cost Project	Per Production Cycle
Fixed Costs	
Land (The land was rented on a yearly basis)	10,000
Tractor (rented per year)	20,000
Building/Store House (Rent)	70,000
Vehicle (Hire during Harvesting)	15,000
Knapsack Sprayer	30,000
Total	**145,000**
Variable Cost	
Labour Cost Per Production Per Hecatare Per Cycle	227,000
Other Operating Costs	152,500
Total Variable Cost	**379,500**
Procurement of Foundation Seeds	**12,000**
Administrative Costs	
Utilities (Per Hectare Per Cycle)	**69,240**
Total Operating Cost	**448,740**
Total Cost	**605,740**

Finanacial summary	Production Performance
Description	SAMSUG 45
Average Yield Per Hectare(100Kg bags)	25
Operating Costs	379,500
Total Revenue	1,750,000
Cost of Foundational Seeds	12,000
Gross profit	1,370,500
Admin Expenses	69,240
Profit Before Depreciation	1,301,260
Shared Cost of Fixed Asset	145,000
Profit Before Tax	1,156,260
Tax (zero for start up businesses)	5,000
Net Profit from Production	1,151,260

Who we are

IITA is the lead research partner facilitating agricultural solutions for hunger and poverty in the tropics. It is a member of the CGIAR Consortium, a global research partnership that unites organizations engaged in research for sustainable development for a food-secure future.