MOREP Project

Common beans: Benefits for farmers engaging in market-oriented production

Background

In areas like Dororo, in Manica district, Central Mozambique, commercialization of common beans (*Phaseolus vulgaris* L.) is one of the most important strategies for farmers to improve their livelihoods. Young farmers and women especially invest in common beans as a way to build their assets and secure their family needs. Engaging in an Innovation Platform (IP), these farmers have learned that they can benefit more from common beans.

Farmers observed how the integration of legume crops (common beans and mucuna) and livestock for soil fertility management through crop rotation, cover crops and manure reduces the dependence on external inputs. Combined with draft power animal management this has increased productivity and production of common beans.

The IP has empowered farmers' participation in markets. Farmers became more organized. Increased production and productivity allowed farmers to sell larger volumes in bulk. They now collectively decide at what time they would sell their produce and at what price, expecting 50% higher revenues than what they would get by selling individually.

This leaflet illustrates common bean production and market practices generated through demonstrations in the MOREP project. They are useful for farmers in similar environments like in Manica district.

Benefits from common bean production for smallholder farmers

- Source for food security and nutrition: Common beans are high in protein, complex carbohydrates, vitamin B components (thiamin, folic acid and niacin) and micro-nutrients (iron, zinc). For institutions like schools and hospitals, low-income consumers in rural and urban areas, they are an affordable source of high quality nutrition.
- Source of income for farmers: Common beans provide a market opportunity, with a high demand in urban and rural areas in Mozambique, and at international markets. Common beans provide farmers with high returns on investments, require less labor and external inputs than many other crops.
- Soil fertility improvement through biological nitrogen fixation: Where farmers have limited resources and poor access to input markets, organic sources of nitrogen are vital. They improve soil fertility and structure, also for competitive crops like maize.
- Women empowerment: As women are mainly responsible for cultivation of common beans, engaging women in competitive markets is a way of empowerment.

How can smallholder farmers improve their production of common beans?

Appropriate agronomic conditions for common beans

- Common beans grow well on more productive types of soils. They are, however, most frequently grown on low yielding soils. Common beans grow best on soils with median soil pH between 5.0 and 6.0. Phosphorus is the most frequent deficient soil nutrient; soil nitrogen is also often limiting. Potassium can be a constraint.
- Common beans grow well in areas with annual rainfall between 400 mm and 1,200 mm. Temperature should be ideally between 15-23°C, the day length of growing period should be around 70 days for short duration varieties, and 110 days for long duration varieties.
- There are two distinct production periods in Mozambique: The main period is from February to June, sown after other crops, to use residual soil moisture and take advantage of lower temperature. The second production period is from August to September.
- Common beans in Mozambique can be classified into two large seeded beans (Andean types) and small seeded beans (Mesoamerican types), depending on the origin of the gene pool.

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Partners: IIAM, ICRISAT

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Table 1. Most common seed types of common beans in Mozambique.

Seed types		Purpose	Characteristics
Red		Local market demand and for household consumption specially in Angonia and border areas with Malawi	Tolerant to low fertility (N, P), and low pH. Often grown in mixtures.
Sugar		High market and export potential, if good quality (non mixed) can be ensured	Usually low yielding under low input conditions, susceptible to biotic stresses, more tolerant varieties now available.
Calima (red mottled)		High demand in urban areas and for export (popular taste, short cooking period)	High yielding under low input conditions, specially under low phosphorus availability.
Cream		High demand for household consumption and at local markets	Kidney shaped large seeds. Mostly grown in Niassa and Nampula. Short cooking time.
White		Less consumed at household level, but accepted in some urban markets	Seed type can be small or large. Very short cooking time. Susceptible to pests during storage.
Black		Less consumed at household level because of 'painting' the food after cooking. Grown mainly for urban markets	Small seeded. High tolerance to abiotic and biotic stresses, including foliar diseases, storage pests.

Management of common beans

1. Soil preparation

Soil preparations should start before the first rains, in order to provide appropriate conditions for seed germination and plant development, including air circulation, improved infiltration, soil temperatures as well as for weed control.

The first plowing using animal draft power must be carried out 30-45 days before sowing, to crack possible hard layers beneath the seedbed and for decomposition of plant residues (25 to 35 cm). Heavy soils need deeper soil preparation for better water penetration. The 1st harrowing should be held 10 to 15 days after plowing. The 2nd harrowing should be immediately before sowing, to level the seed bed.

2. Sowing

Farmers should choose cultivars for which there is a market. It is important that they verify seed quality, consulting seed inspection services. Before sowing, they should dress seed with Thiram.

Seed rates vary from 45 to 65 kg/ha. The right spacing is 60 cm x 15 cm for single crops, and 90 cm x 25 cm for intercropping in order to minimize plant competition for light, nutrients and water.

3. Soil fertility management

Common beans need soil fertility management to ensure that the right quantities of essential macro- and micro-nutrients are available at the right time, for plant establishment, growth and reproductive processes. Under improved management smallholder farmers should apply the following key nutrients, depending on soil types and varieties:

It is important to keep soil pH in the range of 5.8 to 6.2 for an optimal growth of common bean. In order to correct soil pH, lime can be applied 6 months before planting at amounts depending on the soil acidity level. To grow beans, soil nutrient content should be enhanced using the following fertilizers and amendments:

Joint land preparation on demonstration plots: planting common beans in lines.

Inorganic fertilizer:

- Lime (1-1.5 t/ha, at least 6 months before planting and repeated every 3-5 years)
- Basal fertilizer (Compound L, 150-300 kg/ha, after sowing)
- Gypsum (100-300 kg/ha, 7-8 weeks after emergence). On sandy soils split the application at 7 and 10 weeks each.

Organic fertilizer (manure): Apply 5,000 kg/ha good quality cattle manure (this quantity can replace the above mentioned quantities for inorganic fertilizer).

Intercropping: The plant density of both crops should decrease to reduce competition. Spacing should be, for example, for maize at 80 cm x 120 cm between rows and 25 cm between plants in the row. Beans should be planted between maize rows, at 15 cm x 20 cm between plants within the row. The spacing depends on the varieties of both maize and beans. If the maize variety is early maturing, the row spacing should be decreased to 80-90 cm; if it is late maturity, the spacing should be increased to up to 120 cm. The same in relation to beans: spacing within planting rows should be reduced to 10 cm for varieties with determinate growth habit. For varieties with indeterminate growth habit, the spacing can be increased to 15-20 cm between plants within the planting row. This will allow the right plant populations for both crops and reduces plant competition for resources (light, nutrients and water).

Crop rotation: In order to help control pests and diseases attacking beans, crop rotation is recommended. Try rotating bean with a non-leguminous crop such as maize, sunflower, wheat or rice.

4. Improved production technologies

Common beans can be produced as single crop, or intercropped with cereals such as maize, sorghum or pearl millet, or planted in rotation with cereal crops. The advantages of intercropping or crop rotations include: a) better soil fertility management, b) better pest and disease control, c) crop diversification as part of risk management, d) enhanced productivity at reduced production costs.

During the growing period, the field should be maintained free of weeds. Weeding should be carried out twice, 10-25 days after sowing (manual or plough), and manual weed control after 1st flowering.

Appropriate pest management is critical to prevent disease and pest infestations, and to treat whenever a certain symptom is spotted.

Table 2. Major fungal diseases and pests for common beans in Mozambique.

Disease	Characteristics	Treatments
Angular leaf spot (ALS) caused by *Phaeoisariopsis griseola*	ALS affects the foliage and pods of beans in the field during the growing season. All parts above the ground are susceptible. Leaf lesions appear as gray or brown irregular spots having a chlorotic halo. Pod lesions are reddish brown, circular spots, usually surrounded by a darker colored border.	Approved fungicides should be applied when the disease first appears and conditions are favorable for disease development. ALS resistant cultivars are available.
Rust	More in mid-altitude areas, increases with soil pH. Crop residues are the primary source of fungus inoculum for the next season. Rust affects leaves and sometimes stems and pods. The first symptoms appear on the undersurface of leaves as tiny, white, raised spots. These spots gradually enlarge and form reddish-brown pustules that erupt to release rusty masses of spores.	Management practices are important in preventing the initial infection. Two to three year rotations are recommended. Following harvest all crop residue should be buried by plowing. Chemical control of rust infections is accomplished if the disease is identified early. Bravo, Maneb, Maneb plus zinc, and certain copper and sulfur compounds are currently registered for use. Must follow label directions.
Anthracnose, caused by *Colletotrichum lindemuthianum*	More in areas with higher altitude. The fungus survives in crop residues and can be spread through seed, air and water. It can affect all the above-ground tissues of the bean plant. Lesions first appear as water soaked lesions that darken. Spores then form within a gelatinous matrix in a spore bearing structure that ruptures the host cuticle.	Currently seed treatments with certain copper fungicides are common. Look for resistant varieties and rotate every three years to reduce the buildup of disease inoculum. Apply mancozeb in rates of 200g/100 liters of water.
Halo blight caused by bacterium *pseudomonas syringae*	It can affect both leaves and pods. On leaves, small, angular, water-soaked spots appear first on the lower leaf surface. On the pods, the oval water-soaked spots may increase up to 8 mm in diameter and become slightly sunken and reddish-brown with time.	To control the disease, try to rotate crops, do deep plowing and use pathogen-free seed. Seeds should be treated with streptomycin or substitute. In the field, spray diseased plants with copper-containing chemicals weekly after first observation of symptoms. Try to plant halo blight resistant varieties. Harvest earlier, ie, before pod lesions turn brown.
Bean stem maggot (*Ophiomyia* spp.)	Insect caused problem of the greatest concern, during late planting and unfavorable seed growth in semi-arid areas. The leaves of damaged plants show mining tracks where the maggots feed. The lower parts of the stems become dry, swollen and cracked. Attack by this pest often causes death of young bean plants.	To control bean stem maggot, try to do the following: Plant early right before the rains start. Treat bean seed using insecticides: Remove remains of bean stems from the field after harvest. The pest may hide in the old stems and attack young beans in the following season.
Helicoverpa complex or African bollworm	Caterpillars of the African bollworm feed on leaves, buds, growing points, flowers and fruit. Leaf damage reduces leaf area, which can slow plant growth. Larvae feed on leaves, flower buds, flowers, grains, and bore into pods and fruits. Excrements (faeces / waste) of the feeding caterpillars are evident on damaged plant parts.	Measures include management practices such as crop rotation and intercropping; biological control through natural enemies that feed on larvae and eggs; chemical control through the use of recommended pesticides; and the use of biopesticides or botanicals, including the use of Bt (Bacillus thuringiensis) subspecies.
Bruchids, including *Zabrotes subfasciatus* and *Acanthoscelides objectus*	Insect in areas with warm conditions. Cause heavy post- harvest losses.	Chemical treatment after harvest, prior to storage; Use bruchid resistant varieties.
Main sources: Allen et al. (1996); Buruchara et al. (2010).		

5. Harvesting

Common beans can be harvested 60 to 120 days after planting, depending on the variety and growth type. Early maturity varieties can be harvested earlier. They mature faster but bring lower yields. They are more appropriate where rain is uncertain. The late maturing varieties have longer phenology period allowing them to accumulate more biomass that is then translated to pod formation and pod filling.

Pod harvest from the field should be done early morning, because as temperature rises the pods become very dry and pods can open when removing from the shoots and let the grains fall into the ground. After harvesting the plants from the field, the plants should be left to dry for a couple of days before separating the pods from the plants. The pods should then be dried for one day in sunlight and then plied with a stick to allow grains to come off the pods. When picking the pods make sure to discard diseased, sprouted, or insect damaged pods. Separate pods from the grains. The grains should be dried in sunlight to 13-14% humidity, a process that takes 2-4 days depending on the intensity of the sunlight and temperature. Chemical or biological pest treatments should be performed before storage in a cool and dry place to avoid infestation by insects like bruchids.

As it is a self-pollinated crop, farmers can retain seeds for the following 2-3 seasons. It is, however, important to then renew the seed by acquisition of high quality improved seeds.

What markets work for smallholder farmers?

So as to move from subsistence to market oriented production, farmers should follow improved marketing practices, including the following:

Sales period: Instead of selling common beans after harvest, farmers should conserve and store the beans. Selling at least 4 months after harvest could mean farmers get 50% higher prices, which would translate into higher revenues. However, this would require farmers to have adequate and safe storage facilities. In addition, by foregoing selling their produce now in order to sell later, it means farmers cannot obtain cash immediately, which they might be needing badly at that moment. This means solutions need to be found for farmers to overcome cash constraints during the period that they are storing their produce.

Collective sales: By forming better organized communities, eg, associations, farmers can assemble larger volumes of beans for sale and thereby become more attractive to buyers. Furthermore, they will have stronger negotiation power to determine prices. They can refuse to sell below a certain price. If farmers are organized they can also negotiate with seed companies and supermarket chains, which can offer to buy in bulk,

A woman farmer explains all steps for planting and managing common beans at a field day.

and at the same time offer them a higher and attractive price for their produce. Collective selling also might save the farmers on some transaction costs such as transport.

Quality insurance: Farmers controlling quality seed using seed services are more confident about what they will harvest from what they plant. Usually consumers are prepared to pay higher if they are assured of a high quality produce. If the produce is of higher quality, farmers can also attract high-end traders, retailers and consumers who require high quality and pay more for it. Farmers need to grade their beans before selling in order to get premium prices for the good grades.

Contract farming: Binding arrangements with buyers provide farmers not only with higher prices for their produce, but also secure market. Government services can assist to establish the terms to benefit farmers.

Key messages

- Common beans are one of the most important food legumes in sub-Saharan Africa (Lynch 1995). In Mozambique, common beans are considered as a food and cash crop, especially in the central (Tete and Manica) and northern (Niassa) provinces.
- Diversifying and intensifying farmers cultivating common beans can increase production and provide higher surplus for sale. Thereby they can increase farm income substantially. Reinvesting income from beans into the farm raises overall farm productivity and growth.
- Beyond the farm gate, adequate infrastructure and support services, including seed quality control, and exploring national and regional markets are critical for common beans to take off as a cash crop for smallholder farmers.

Possible market options

Farmers do have options to sell their beans. The different market channels have advantages and disadvantages.

	Advantages	Disadvantages
Local markets	Easy, convenient and accessible; no need to travel (save transport costs); less risky; ability to sometimes negotiate the prices for the produce	Low prices; no exposure to external alternative markets, which offer choice; there might not be enough buyers to buy all the produce the farmer has to offer
Traders who come to buy in the village	Relatively higher prices; buy bulky quantities; farmers do not incur transport costs; less risky for the farmer since they are at home; if farmers are well organized they might negotiate the prices with the trader for competitive prices	Can easily manipulate those who are desperate to sell; usually there is less flexibility to negotiate the prices; if the farmers are not organized, the trader might bargain for lower prices with each farmer separately
Farmers selling away from the village (eg, in Chimoio)	Farmers can obtain higher and competitive prices; there is room for negotiations regarding the price since there will be many buyers; the farmers can sell directly to the final consumer, which will get them even higher prices for the produce	Risky – farmers are exposed to theft and other risks; farmers have to incur transport costs; if their produce is not bought quickly enough they might be forced to reduce prices. If the price is not conducive the farmer might have little options left
Contract farming	Farmers have a guaranteed market; quantity and quality requirements are stipulated and known in advance; hence farmers manage their produce using the requirements as targets. This makes planning easier. Knowing in advance price per grade removes uncertainty on the farmer's side; farmers can benefit from contract packages that include appropriate seed varieties, fertilizers, agro-chemicals, payment for labor as well as extension support.	Farmers may be tempted to side-market their produce, thereby jeopardizing their reputation with the contracting company; farmers thus must fully understand and appreciate the significance of contracts. Less flexibility in terms of prices and quantities traded; if the farmer does not manage the crop well, it might mean that even if they sell the produce, they might be left in arrears.

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