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**Good agronomic practices for legume production in Ethiopia, focusing on faba bean**

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**Introduction**

**Why is this issue important to listeners?**

Because farmers and others involved in legume production should know:

* The benefits of legumes for small-scale farmers, consumers, and Ethiopia in terms of food security and income generation.
* The nutritional values of legumes.
* The contribution of legumes such as faba beans to soil fertility.
* How to access quality seed varieties and information about improved agricultural practices and inputs.
* How to prevent faba bean diseases and pests.
* Appropriate ways of preparing land and the best sowing time for faba beans.
* Recommended ways to harvest faba bean that minimize losses.
* The benefits of Alemayehu Row-Seeding Technology.
* The benefits of Farmers Training Centers.
* Available mechanization services.

**Facts about legume production in Ethiopia**

* Ethiopia is one of the top ten producers of legumes in the world, the second-largest producer of faba beans after China, and the fifth or sixth largest producer of chickpeas.
* Legumes occupy about 13% of cultivated land in Ethiopia and are critical to small-scale farmers’ livelihoods.
* Legumes are grown for a number of reasons:
	+ For household consumption and nutrition.
	+ For household income.
	+ To improve soil health.
* Legumes are a cost-effective household source of protein.
* Legumes are climate-smart as they simultaneously adapt to climate change and contribute towards mitigating its effects.
* There are about ten types of legume crops growing in Ethiopia in significant volume. Faba bean is the first in volume of production and cultivated area, followed by field peas, haricot bean, chick pea, and lentils.
* Although legumes have great nutritional and environmental benefits, they are considered as secondary crops in most parts of Ethiopia. Thus, they do not receive as much investment and policy attention as cereal crops such as teff, wheat, maize, barley, sorghum, and millet. This lack of investment and policy attention negatively affects land allocation to legumes.

**Key information on faba beans in Ethiopia**

* Faba bean is the most important pulse crop in Ethiopia. Pulses occupy 14% of the cultivated land in the nation, and 1.5% is devoted by faba bean.
* The popularity of faba bean has increased recently. Its high yield makes it attractive to producers, while its high protein content and low price make it attractive to consumers.
* Faba bean is an important crop in Ethiopia as it is one of the major food items in Ethiopian food culture. Faba bean is consumed in various forms, with traditional faba bean dishes such as *full*, *nifro*, *ashuq*, and *shiro wot* the most common.
* Faba bean production and productivity are affected by various constraints, including the emerging faba bean gall disease.
* Production of faba beans in Ethiopia is entirely rain-fed.
* Faba bean is a major source of income for farmers in many parts of Ethiopia.
* Faba bean has invaluable benefits to growers as it fixes nitrogen in the soil, thereby improving soil fertility.
* In Ethiopia, faba bean producers are generally small-scale farmers who use traditional farming practices. Since faba bean is also a major food item in farming families, it is supplied to the market only when small-scale farmers’ yields exceed their annual consumption requirements.

**Major challenges of legume production in Ethiopia**

* Farmers lack a sufficient number of improved seed varieties and farming inputs such as fertilizer, pesticides, and herbicides.
* Inadequate availability of seed varieties that are high-yielding and resistant to diseases.
* A limited focus on legumes in extension services.
* The lack of proper attention by farmers to post-harvest loss.
* The long market chain affects the price that farmers receive. There are multiple intermediaries between farmers and the final market destination, particularly for export crops.
* The lack of irrigation.

**Impact of climate change on faba bean production**

* The major impacts of climate change on faba bean cultivation are a shorter growing season and increased drought.
* Shorter growing seasons can cause poor germination and crop failure.
* Adjusting the planting date is difficult because farmers lack access to accurate weather forecasts.
* Drought hinders faba bean growth by reducing germination rate, flowering, and productivity.
* Droughts tend to reduce plant height and weight, fresh and dry shoot weight, leaf area, and the amount of chlorophyll \* in the plant.
* Higher temperatures and drought increase evaporation, which causes water stress. Water stress makes land preparation difficult and costly because dry land is difficult to plough and land preparation requires more labour.
* Drought contributes to more frequent outbreaks of faba bean diseases, including chocolate spot disease, aphid-vectored diseases, and faba bean rust disease.

**Gender aspects of legume production in Ethiopia**

* More mechanization could result in women becoming more important in legume production.
* Women are heavily involved in production, conducting the majority of on-farm labour during both planting and harvest, with additional activities in value addition.
* Access to land and decision-making power in agriculture in Ethiopia has favoured men for many years, although women currently have equal access to land by law.
* In legume production and marketing, the introduction, demonstration, and uptake of technologies associated with legumes is dominated by men.
* Men gain knowledge and skills from trainings organized by NGOs and government, orientation from experts in government and the private sector, visits, and informal sources. In contrast, women rely on informal sources to acquire knowledge and skills and consequently have little or no information about new varieties and technologies. As a result, men dominate decisions about which types of seed to grow and which technologies to use.
* Men and women share the workload in faba bean production. Men are more responsible for land preparation, tillage, seed selection, sowing, and harvesting. Women are also involved in sowing seeds but not in seed selection because they lack the knowledge and skill; they also support men during land preparation and tillage, and conduct most of the weeding.
* Women are mostly responsible for threshing, winnowing, and storage.
* The volume of the common beans sold by men and women varies between households. Women may sell up to 20 kg per season, often in small amounts when cash is needed at home, while men sell between 100–600 kg and control the resulting income.
* Women have control over beans which remain at home for consumption.
* While the workload is shared between men and women at many stages of faba bean production, women’s right to access the benefits of marketed faba bean is very limited.

**Key information about legume production**

**Site selection for faba beans**

* The recommended annual rainfall for faba bean cultivation is 700-1000 mm per year. Rainfall should be distributed consistently during the growing season.
* Faba bean is widely produced at an altitude of between 1800 and 3000 metres above sea level. At altitudes below 1800 metres, the crop can be affected by drought and disease. Above 3000 metres, it can be affected by chilling injury and decrease yields.
* Faba beans must be planted in warm soils.
* Faba beans can grow on a wide range of soils provided they are not too acidic or saline. Deep, well-structured clay soils are ideal and sandy loam, sandy clay loam, or clay loam soils with a clay content of 15-35% are also suitable.
* Soil temperatures from germination to maturity should average 20-25oC.
* Climate and soils that are suitable for wheat and barley production may also be appropriate for faba bean production.

**Land preparation**

* Faba bean is sensitive to compaction of surface and deep soil because its roots are not able to penetrate compacted soils.
* Plow 2-3 times with a local plow or conduct one disc plowing followed by two disc harrowings.
* Starting land preparation early encourages weed seeds to germinate so they can be destroyed in subsequent cultivations.
* Land should be ploughed as soon as possible after clearing the preceding crop. It is recommended to incorporate crop residues so they can decompose before planting faba beans.
* Ideally, soil should be loose and soil texture should be fine. If the site is waterlogged, farmers should create a drainage system to remove excess water from the farm.
* In areas that experience droughts, tied ridges\* can conserve soil moisture and reduce evaporation.
* Proper land preparation is important to improve water filtration and soil aeration, and decrease loss of soil moisture. It can also improve germination, root growth, weed control, and decrease soil-borne diseases and pests.

**How farmers can access mechanization services**

* The use of agricultural mechanization is low in Ethiopia.
* Mechanization, especially combine-harvesters, has been rapidly adopted in the wheat-growing areas of southeastern Ethiopia that are well-suited to mechanization for a variety of reasons, including the economies of scale that can be achieved in these areas.
* Many commercial farms are in southeastern Ethiopia, which has encouraged the development of machine rental markets.
* Commercial service providers have rapidly emerged, especially for combine-harvesters.
* While a large share of the tractors in good working order are used by larger commercial farmers and state farms, there is increasing uptake of mechanization by small-scale farmers, especially wheat farmers.
* Commercial mechanization service providers that provide ploughing, harrowing, and harvesting services for a fee are rapidly emerging.
* Mechanization is hampered by constraints related to the small and fragmented plots used by small-scale farmers in Ethiopia, Ethiopia’s rugged topography, and the widespread presence of stones in fields, which complicates mechanized plowing.

**Sowing**

* Sowing at the appropriate time is vital. It’s important to sow when the soil is moist. Sowing too early causes the beans to be affected by continuing rains. If rain continues after seeds are mature, they may begin to germinate inside their pods. Sowing too late results in a shortage of rain. Generally, the most suitable sowing time in Ethiopia is the end of June or early July.
* If there is insufficient soil moisture, seed germination may fail and reduce yields.
* Treat seeds before planting with an appropriate fungicide and insecticide to manage soil-borne diseases and pests. Crop rotation and isolation of the crop is an alternative form of biological control as an alternative. It is important to plant varieties with resistance to specific diseases.
* Depth of planting is important. Depending on the size of the seed, type of soil, and climate, it’s recommended to plant seeds at a depth of 2-6 cm.
* Under hot, dry conditions or when rainfall is unreliable, sow more deeply to give the seed more protection from the sun and reduce the risk that the seed will germinate prematurely from light showers. However, deep sowing in heavy soils and good rainfall will result in poor emergence.
* Plant faba bean seeds 7-10 cm apart in rows 40 cm apart.
* Depending on the variety and size of seed, the seeding rate per ha ranges from 150-175 kg for small seeds to 200-250 kg for large seeds.

**Access to improved seed**

* In Ethiopia, improved seeds are distributed by public, private, and seed-based cooperative unions and seed producer co-operatives.
* Government and private seed companies in Ethiopia typically supply no more than 10% of the seeds for most food crops.
* Direct seed market: This refers to a seed access system in which farmers are required to register with a development agent (extension agent) before the start of the planting season to receive certified seed through the district agriculture office.
* Farmers who have improved seed may sell it to other farmers.
* High prices and lack of a timely supply of improved seeds are major constraints to crop production.

**Row seeding**

* Row seeding with the recommended distance between rows will increase productivity by providing sufficient aeration, moisture, sunlight, and nutrients.
* Broadcasting requires higher seeding rates than row seeding while also reducing yields.
* In broadcasting, hand weeding and hoeing are more difficult, and competition from weeds lowers plant growth and yield.
* There is a low level of row planting in Ethiopia, using animal-drawn or tractor-mounted row seeders.
* Despite efforts to promote row seeding, it is mainly practiced by state-owned seed enterprises because of the following factors:
* Tractor-mounted row seeders are relatively complicated and need a minimum level of technical skill and experience to regularly adjust and calibrate them, both of which are in short supply.
* Fewer row seeders are available and used than tractor-mounted ploughs.
* Manual row seeding is highly labour-intensive and constrained by a lack of family assistance or seasonal labour.

**Alemayehu Row-Seeding Technology (ART)**

* Alemayehu Row-Seeding Technology (ART) is a simple piece of agricultural equipment developed by Alemayehu Wondefrash that is drawn by a pair of oxen and plants seeds in rows.
* The ART consists of three components: ridger, levelling board, and cultivator.
* All three components are made with locally available materials, tools, and equipment.
* The row maker or ridger is used to make ridges and furrows after ploughing and prior to broadcasting.
* After broadcasting, farmers use the levelling board to create crop and crop-free bands, thus enabling row seeding.
* At the early tillering stage, farmers use the cultivator to uproot weeds between rows.
* ART saves seed and labour and increases yields.
* ART makes hand-weeding and hoeing easy.

**Weeding and herbicide application**

* Faba bean does not compete well with weeds, particularly in early growth stages. It can easily be affected by broadleaf weeds and for 3-6 weeks after germination, frequent weeding is required. It is recommended to apply herbicides to manage grassy weed species after the crop emerges, from the time it has 3-4 leaves to the flowering stage.
* Weeding faba bean late in the season reduces yields because of mechanical damage to plants.
* Weeding is easier in row-planted beans.
* Weeding at least once during the early growing season (up to 15 days after emergence), has been found to result in better yields then weeding twice 10–15 days after emergence and 30-35 days after emergence.
* It is not advisable to weed during and immediately after flowering to avoid flower abortion, increased incidence of disease, and mechanical damage.
* Before faba beans mature, remove late-emerging weeds. Weeds in the grass family can be managed by herbicides registered for that purpose.
* Weeding includes:
	+ cultivating between rows twice during early stages of plant growth using a mechanical cultivator,
	+ weeding by hand at later stages if required, and
	+ applying herbicides.

**Fertilizer application**

* Low adoption and limited use of chemical fertilizers, averaging 25 kg/ha, most of which is applied to cereals, is a major factor limiting crop yields in Ethiopian agriculture.
* Small-scale Ethiopian farmers typically apply two types of fertilizers: inorganic fertilizers (for example, urea and di-ammonium phosphates) and fertilizers from manure and crop residues.
* The limited use of chemical fertilizers on legumes is due to the lack of awareness of the benefits of fertilizer for pulses, as well as the limited access to credit and a lack of imported phosphate fertilizers.
* High-quality chemical fertilizers are imported, which makes them costly and difficult to access.
* Fertilizers reach farmers through co-operatives and unions of farmers’ associations.
* Depending on the fertility of the soil, it is recommended to apply 100 kg/ha DAP and 50-100 Kg/ha urea fertilizer. On light soils, 100 kg of NPS per ha is recommended for faba bean production.
* It is recommended that faba bean growers dress seeds with Rhizobium inoculant as a bio-fertilizer. This encourages fixing of atmospheric nitrogen by roots, thus increasing soil fertility and yield.

**Benefits of legumes for soil quality**

Growing legumes results in:

* Increased soil fertility.
* Improved soil porosity. \*
* Greater recycling and better availability of soil nutrients.
* Improved soil structure.
* Decreased soil pH.
* Greater diversity of soil micro-organisms which, among other things, improve nutrient recycling and nutrient availability and manage disease.
* Reduced disease and weed problems, because rotating from cereal crops to legumes breaks the build-up of disease organisms and weeds.

**Harvesting**

* When the crop is meant for dry seed, harvest when fully mature. When grown for consumption as a vegetable, harvest when green.
* The most common harvesting system in Ethiopia is to pull and thresh the crop by hand.
* Faba bean generally matures 90-220 days after planting, depending on variety and climate.
* If grown for use as dry beans, the crop should not be cut until the lower pods are mature and the upper ones fully developed.
* If the harvest is delayed until the upper pods are ripe, pods may shatter, resulting in great losses.
* Cut the crop on cloudy days or at night.
* If farmers harvest late, they risk rains splitting the pods, leading to fungal disease.
* Faba bean is not suited for combine harvesting and simultaneous threshing. But harvesting by hand is economical where labour is available and inexpensive.

**Threshing and storage**

* Seeds which have been improperly threshed may appear intact and normal, but may have small cracks or internal damage that produces seedlings with disorders that lead to seedling death or stunted growth.
* Properly-cured seed has enough moisture to stop threshing causing small cracks, but a low enough level of moisture to prevent internal damage to the embryo.
* The method of threshing is matched to the volume of seeds to thresh and the equipment available. Thus, threshing by hand is a suitable method for processing small amounts of seed.
* Pods can be either split by hand or placed in a plastic tub and rubbed between the hands, in which case it is advisable to wear gloves.
* Seeds should be stored in a dry, cool place, free of pests, and at least 30 cm off the floor to avoid the seeds absorbing moisture.
* Seeds should be treated with proper chemicals to prepare them for storage. Treating the seeds with pesticides not registered for that purpose may result in poor germination.

**Crop rotation**

* Rotating between cereal and legume crops increases soil fertility and yield, decreases disease incidence, and manages weeds and pests.

**Common faba bean diseases in Ethiopia**

* Faba bean gall can cause losses of 30-100%. Seed dressings and foliar fungicides have some effect against faba bean gall.
* Faba bean rust can cause losses of up to 30%. The risk of faba bean rust can be reduced by burning or burying old faba bean stubble, and by rotating crops. Fungicides may be used to control faba bean rust in areas where the disease is most prevalent.
* Chocolate spot is the most widespread disease of faba bean, causing losses of up to 60%.
* Management of chocolate spot should follow the principles of integrated disease management, and include:
	+ crop rotation and separation of faba beans from the previous year’s crop residues by a minimum of 500 metres,
	+ growing resistant varieties,
	+ using clean seed and fungicide seed dressings,
	+ managing the crop canopy by varying the sowing time,
	+ using the recommended seeding rate and row spacing,
	+ regular crop monitoring,
	+ strict hygiene on and off the farm, and
	+ strategic use of foliar fungicides.
* Varieties with resistance to chocolate spot should be grown in areas where the likelihood of chocolate spot is high. The risk of disease can also be reduced by destroying all faba bean trash and self-sown plants before sowing, and by sowing disease-free seed in a recommended crop rotation.
* The effect of airborne fungal diseases on yield varies between seasons and regions. Some diseases affect large faba-growing areas of the country and cause large losses in quality and quantity.

**Farmer Training Centers**

* Farming Training Centers provide a wide range of services, including:
	+ Training and extension services on improved farming techniques through courses, exhibits, demonstration farms, field days, and farmer-to-farmer extension.
	+ Market-oriented information and advisory services.
	+ Meeting and communication facilities.
	+ Seeds and seedlings of new crops, including vegetables, fruit, and forage varieties.
* The government budget is tight, so after paying staff salaries, there is very little money left for regular activities. This limits the types of work that the training centres can undertake.

**Definitions**

*Chlorophyll:* A green pigment found in plants. Plants use chlorophyll and light to make food.

*Porosity:* The degree to which a soil is occupied by pore spaces, defined as that portion of the soil not occupied by solids, and normally occupied by air and water.

*Tied ridges:* A raised strip of arable land crossed by earth bands (called ties) within the furrow.

**Where can I find other resources on this topic?**

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