

DEPARTMENT OF AGRICULTURAL RESEARCH



The Investigator, the light on the farming zone

# DRY BEAN PRODUCTION MANUAL LESOTHO

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**Agronomy**

**20/02/2018**

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# DRY BEAN PRODUCTION IN LESOTHO

## INTRODUCTION

Dry bean is a crop which originated in Central America (small seeded beans) and the Andes Mountain in South America (large seeded beans) within the genus *Phaseolus*, there are three species which are agronomically important in Southern Africa. Within each species, there are different seed types that differ in respect to size, form and colour. The seed of cultivars within types does not differ much, but differences in adaptability, growth habit and length of growing season.

In the highly competitive global economy and climate change of today, successful dry bean production can only be ensured by the continuous development of applicable technologies and its effective transfer. The technological information in bean production is primarily of a medium to long term nature. Short term production information that changes on an annual basis, for example, aspects such as a cultivar choice and pesticides availability are entirely depended on the present growing season, but production system such as conversional or conservation agriculture are long term technologies which are used from season to season.

## TEMPERATURE

Dry beans are an annual crop that is well adapted to the hot season. They grow at optimum temperatures of 18°C - 24°C. After emergence, day temperatures below 20°C retard bean growth. After flowering, low temperatures will lead to the formation of pods without seeds, low night temperatures during pod filling will extend the growing season especially in case of long season Red speckled beans. Beans have to be planted in warm soil preferably 18°C and only once the danger of frost is over, the night temperature has to be 13°C or higher. The yield of dry bean is adversely affected by higher temperature during the flowering stage. The average maximum temperature during flowering stage should not exceed 30°C. Higher temperatures during flowering stage lead to abscission of flowers and poor pod set, resulting in a reduced yield.

## RAINFALL

For dry land conditions a total annual rainfall of 650 – 750 mm is regarded as ideal with a minimum of 400 – 450 mm in the growing season. Low relative humidity lead to flower abscission and low pod set which is aggravated by low soil moisture.

## SOIL PREPARATION

Seedbed preparation for the planting of dry beans is the same as for any row or field crop to be planted in spring. The seedbed must be deep, even and firm. A firm seedbed ensures better surface conduct between the soil and the seed, which promotes moisture absorption. This is particularly important in dry seasons. An even or level seedbed ensures uniform planting depth and easier mechanical harvesting of the crop. But, however, beware of a too fine seedbed, if the soil tends to compact easily when it rains, because beans emerge with difficulty under such conditions. Undecomposed crop residue at planting time, increases the danger of root diseases. It is beneficial to

incorporate residue into the soil after harvesting so that it can begin to rot when the first rains fall. It is recommended that beans be planted in a ploughed field where the crop residue has been worked very well. This crop grows in most soils of Lesotho. It grows best with soils that have some clay of 10%. Lime is not needed for this crop unless acidity is severe at pH 5 or below.

## FERTILIZATION

Beans are very efficient users of available plants nutrients and for this reason they react poorly to fertilization. If beans are fertilized too heavily, they produce large, strong plants with low grain yields. Generally it is recommended that beans be planted on soils which have been well fertilized previously. General fertility is more advantageous than direct fertilization because the beans are sensitive to high concentration of mineral salts. Fertilizer requirements are not great but our data shows that to achieve high yield 2: 3: 2 (22) should be applied at rate of 4-6 bags / hectare.

## PLANTING DATES

Since the soil must be moderately warm (13° or above) the earliest plantings should occur around the first of October and can continue until about 15<sup>th</sup> January in warm areas but in cold areas yield go down with each date after November. From 15<sup>th</sup> of January bean yield are greatly reduced or lost to frost. Cultivars with growing season of 85 to 100 days are planted on highlands from October to end of November. And the cultivars with a growing season of 90 to 115 day planted on the lowlands and foothills from fist October to 15<sup>th</sup> of January.

## SPACING, PLANT POPULATION AND PLANT DEPTH

The inter-row spacing for all dry beans is 90cm at the present. This spacing facilitates the use of machinery. This spacing is ideal for large seeded beans and is quite acceptable for the medium and long season cultivars. Short season cultivars (85-90 days) have very small plants and their yield can be improved by closer row spacing (70-75 cm). However, spacing should allow essential mechanical weed control. These row spacing are also applicable to beans under irrigation.

Plant population and the quantity of seed required should be calculated depending on the cultivar and the spacing to be used. Plant population ranges from 115 000 – 250 000 plants per hectare. The mass of seed required per hectare will vary between cultivars, depending on the seed size. In case of small seeded beans, this fluctuates between 35 kg and 45 kg, and for large seeded beans the mass varies between 60 kg and 80 kg.

Planting depth is determined by the type of soil and the moisture content. The seeds are placed 3 to 5 cm below the soil surface.

## CULTIVAR CHOICE

The following factors are critical with regard to cultivar choice and successful production:

- Yield potential (yield reliability, mean yield and yield in different production area.
- Seed type (determines the demand and price)
- Seed size (determines the quantity of seed required).
- Growth habit and standing ability.
- Resistance to shattering
- Length of growing season (has an influence on planting and spacing).
- Resistance to different disease (determines input costs and possible production area).

## YIELD POTENTIAL OF DRY BEANS

The results of the National Dry Bean Cultivar Trial which were conducted in Research station are the best indication of the yield potential of the cultivars which are planted in Lesotho. Cultivars differ in their adaptation to different areas due to their sensitivity to factors such as drought, heat and diseases. The average yield, over all the localities and for a specific production area, has to be taken into consideration. Also evaluate the performance of the cultivar over the years of testing. However, the best indication is to plant a promising new cultivar and compare it to the existing and familiar cultivars.

## LENGTH OF SEASON

Pinto Bean mature in approximately 90 days so the crop is a short-season with flowers and pods set in about 45 – 60 days after emergence and the crop is usually ready for harvest in 90 +- days.

Sugar Beans mature in 100 – 120 days so is slightly longer in maturity.

AVAILABLE CULTIVARS / VARIETIES IN LESOTHO

**Table 1: Common Bean varieties, year of release and characteristic for Lesotho**

Agro-ecological Zone	Variety	Improve	Local	Year of release	Rank	Area under Bean	Approx % area coverage per farmers' field	Adoption in %	Characteristics
LOW LAND	<b>SUGAR BEANS</b>								
	-PAN 128	✓		2000	2				High yield, cooks faster 100-120 days to mature. Highly marketable
	-PAN 148	✓		2008	1				High yield, cooks faster 100-120 days to mature. Highly marketable
	<b>PINTO</b>								
	-OLATHE	✓	✓	1989	4				Short season, stress tolerant, early maturing
	-NODAK	✓	✓	1989	3				Short season, stress tolerant, early maturity. It has a bright seed colour and very uniform seed size similar to Olathe Has tolerance to prevalent bean rust races. Nodak is resistant to 2 prevalent strains of BCMV
	-NW 590	✓		1988	5				

	-MKUZI	✓		2006	6				High yield, drought tolerant, early maturity
	-PINK HAROLD		✓	1989	7				
	SMALL WHITE HARICOT		✓	UNOF FICIAL	8				Susceptible to diseases, late maturity. Good for canning
	NATAL YELLOW		✓	UNOF FICIAL	9				Yellowish in colour, cooks longer
	KIDNEY BEANS	✓		UNOF FICIAL	10				
	<b>Calima bean</b>								
	NUA 45	✓		2014	4				-Yield range from 2000– 2400 kg/ha in Highland, 2900– 3500 in Lowland. - Grain type– Red mottled ( Calima beans ) - Takes 90— 100 days to reach physiological maturity. - Large seeded beans, kidney shaped seed ( 55g/ 100 seeds) - Fits well in crop rotation system as relay crop
FOOTHILLS	PINTO								Short season, Stress tolerant, Delicious, Brown in colour.
	-OLATHE	✓	✓	1989	1				
	-NODAK	✓	✓	1989	2				

	-NW 590	✓		1988	3				
	-PINK HAROLD	✓		1989	4				
	SUGAR BEANS								
	-PAN 148	✓		2008	5				Short season, Cooks faster ,High yielding, Red speckled
	-PAN 128	✓		2000	5				
	MKUZI	✓		2006	6				Cook faster, Delicious, Early maturing , High yielding, Susceptible to water logging
	SMALL WHITE HARICOTS	✓		UN OFFICIAL	7				Susceptible to water logging, Delicious, Long season
	KIDNEY BEANS	✓		UNOFFICIAL	8				
	NATAL YELLOW	✓		UN OFFICIAL	8				Cooks longer, Yellowish in colour
HIGHLANDS	PINTO								
	OLATHE			1989	1				- Stress tolerant - Delicious, Short season
	NODAK			1989	2				

	NW 590			1988	3				
	PINK HAROLD			1989	4				
	KIDNEY BEANS	✓			5				- Cooks longer, late maturity - High fibre content
	MARAKABEI MARICO		✓		6				
	MAROON2 WHITE		✓						
	BLACK and WHITE		✓						-Longer to cook - Long season
	SMALL WHITE HARICOTS	✓		Unofficial 1968	9				-Susceptible to water logging -Delicious, Long season
	MKUZI	✓		2006	8				-Early maturity -Delicious
	SUGAR BEANS PAN 128	✓		2000	7				-Late maturity -Delicious
SENQU RIVER VALLEY	PINTO								
	OLATHE	✓		1989	1				-Stress tolerant -Delicious, - Short season

	NODAK			1989	2				
	NW 590	✓		1988	3				
	PINK HAROLD	✓		1989	4				
	SUGAR BEAN PAN 128	✓		2000	5				-Red speckled -Medium- long season -High yielding -Cooks faster
	MARAKABEI BLACK and WHITE BEANS		✓	Unofficial 1968	6				Bik and White in color
	COW PEAS		✓	Unofficial 1966	7				-High yielding -Susceptible to storage pest(weevil)

## WEEDS CONTROL

The successful cultivation of dry beans largely depends on the successful control of weeds. Weed control during the first 6-8 weeks after planting is critical as weeds and crops compete for water, nutrients and light during this period. Weeds compete directly with the crop and up to 100% yield losses can occur if they are not controlled. Dry beans compete poorly with weeds because they are low growing plants which do not overshadow weeds easily. Early control is extremely important because the root system of the plant develops at this stage and it also gives the beans a better chance to overshadow the weeds. Certain weeds secrete chemical substances which limit plant growth. Weed control can be applied mechanically and/or chemically.

### *Mechanical methods*

Weeds can be removed by hand hoeing or mechanically by implements. Mechanical weed control starts at seedbed preparation, and it should continue as cultivation treatments until flower initiation.

### *Chemical methods*

Chemical liquids, pellets and gasses are used to kill seeds and germinating or growing weeds. Herbicides can be incorporated into the soil or applied prior to and /or after emergence.

## BEAN FOLIAGE PESTS

### **Aphids**

*A.fabae* is widely distributed and attacks common bean wherever the crop is grown in Lesotho. Wingless aphid colonise bean plants especially around the stem, growing points and leaves, where they feed by sucking the plant sap. Plants may become desiccated and die. Aphids infestations are more important during dry spells.



*Dry bean plant highly infested by aphids in Thaba-Tseka trials*

### **Flower and Pollen Beetle**

The adults often appear in large numbers and eat flowers, reducing pot set. It may damage only pollen and not feed on petals. Flower and pollen beetles are difficult to control, because the more vulnerable immature stage occur in the soil.



*Dry bean plant highly infested by flower and pollen beetle in Maseru trials*

### **FUNGAL DISEASES**

#### **Rust**

Rust occurs worldwide, wherever beans are grown. The extent of crop loss depends on the growth stage at which infection occurs, the susceptibility of the cultivar, and environmental conditions. Early infection of highly susceptible cultivars can lead to almost complete crop loss. Minute, yellow, raised spots appear on both surfaces of infected leaves as well as on petioles and pods. These spots enlarge and rupture the epidermis to form reddish brown uredial pustules which may be surrounded by yellow haloes and then by rings of smaller secondary pustules. The dry, powdery spores are typical of rust fungi.



*Dry bean plant highly infested by rust in Thaba-Tseka trials*

### **Fusarium Root Rot**

The entire root system and lower parts of the hypocotyls are affected. The first signs are reddish brown streaks on the hypocotyls and tap root. The streaks progressively become more prominent and the cortex becomes increasingly necrotic. Severely infected root systems show internal discolouration of the vascular tissue below the first node usually later season, this disease also called 'dry root rot because stressful conditions, such as drought, high temperatures and relatively low soil temperature can contribute to disease severity.

### **Conclusion**

The technical information contained in the manual is primarily of medium to long term nature. Short term information that changes on an annual basis, aspects such as cultivar choice, pesticide and herbicides availability, can be communicated through District Crop Production Officer at different districts. Table 1 shows the available common bean varieties according to agro-logical zones of Lesotho and the rank numbers represents the farmers preferences towards particular varieties.



*Good bean crop with uniform crop stand*

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