THE OFF-SEASON CULTIVATION IN TROPICAL REGIONS OF FRENCH BEANS FOR EXPORT

CULTIVATION TECHNIQUES

1- SOWING

Sow in a surface-dried soil, 24 to 48 hours after good rainfall or sprinkler irrigation.
Do not sow into dry soil, sowing should be done on finely tilled soil in which furrows have been ploughed.

Depth of sowing: 30 to 40 mm
Density: distance between rows: 600 to 700 mm
20 seeds per linear meter
- In seed holes: 4 to 5 seeds every 250- 300-mm.

Depending on the weight per 1000 seeds of different varieties, the quantity of seeds to be used will vary between 70 and 100 kg/ha.
Optimum density: 30 to 50 plants per square meter.

The extremely delicate platelets must develop in a loose soil (avoid any surface compaction).

2- VARIETIES TO USE

For this type of off-season cultivation for export carried on in Tropical Regions, the object is to obtain the highest possible commercial yields in the extra-fine grades that enjoy the best market prices.

To achieve this objective, certain mistakes, often made in the choice of varieties, must be avoided.

Varieties from the following groups should <u>not be used.</u>

- Beans of the ‘Mange tout du Marché’ or ‘ Bobby’ varieties, which produce high yields, but only in the ’fine’ and above all ‘medium’ grades.

- Beans of the ‘ stringless’ varieties, which produce a high percentage of ‘fine’ grades and little ‘ extra fine ‘. Their pods are not very straight.

- Beans of the ‘Mange tout de conserve’ varieties, which, being intended for mechanical harvesting (single operation), arrive at maturity within a very short period and produce rather short pods in the ‘fine’ grades.

Only ‘Filet’ varieties should be used.

These varieties alone produce a high percentage of straight pods in the ‘extra fine ‘ grades.

The main ‘ Filet ‘ varieties grown in Tropical Regions for these purposes are:

MONEL
ROYALNEL
GARONEL
FINBEL
REGINEL

3- FERTILISATION

BASIC FERTILISATION

Never apply organic fertilizers prior to sowing beans. However, a good organic fertilizer on the previous crop will be every beneficial to the beans.

The formulas used in Tropical Regions depend a great deal on the available fertilizers.

In the Sahel Regions:

Ammonium phosphate: 2 kg per 100 sq. meters
Potassium sulfate: 2 kg per 100 sq. meters
Or 150 kg per hectare of 15-15-15
Or 4 to 500 kg per hectare of 5-10-10.

The standard basic fertilizer usually recommended is 30 N 30 P 60 K.

STAGE FERTILISATION

The standard fertilizer usually recommended is 30 N 30 P 60 K.

Surface fertilization is carried out in two operations:

- First operation: 20 days after sowing, using ammonium sulfate and potassium phosphate or 1,5 kg of 10-12-20 fertilizer per 100 m2

- At flowering: spreading urea - 800g/100 m2 in the Sahel Regions.

The spreading of urea at the flowering stage and on the appearance of the first pods has the effect of prolonging the harvest and gives a better quality, tendered bean. During application, care must be taken not to knock off the flowers. To achieve a good distribution, slight drainage is necessary after spreading, where furrow irrigation is used, if the fertilizer is not to be carried away by irrigation water.

Fertilizer may also be applied in the irrigation water.

* An excess of Nitrogen can lead to an over- development of foliage at the expense of pod formation.

4- UPKEEP

Beans grow better in soils that have been surface-loosened.
Mechanical tilling should only be light to avoid damaging to topmost roots.

-Hoeing is first carried out 20 days after sowing with the application of fertilizer and slight earthling up

- A second hoeing and earthling up to operation is carried out 15 days later.

5- IRRIGATION

Two possibilities:
-By submersion (furrow irrigation)
-By sprinkler

Furrow irrigation is to be preferred in most countries of the Sahel Regions. As irrigation water does not come into contact with the foliage the incidence of fungal diseases is reduced.

Where furrow irrigation is used, good leveling is called for. This operation usually poses no problem in the Sahel Regions.

Sprinkler irrigation is also employed in certain tropical countries where furrow irrigation is not traditionally used and where ground leveling in not possible. In

these cases plant treatments may be required more frequently. Avoid high-pressure sprinklers and heavy drips.

Irrigation should preferably be carried out in the evening or morning periods.

Sensitivity to water shortage is most marked during two periods:

- During the sowing-sprouting period (15 days): risk of poor crop density or staggered sprouting.

- In the pre-flowering period: malformation of pods.

Irrigation on freshly sown ground is never advisable; this is why prior irrigation is so important. From sprouting up to the flowering stage, irrigation is limited in order to encourage root development.

With the appearance of the first flowers irrigation should become abundant.

In Tropical Upland Regions, during cool seasons, irrigation every 5 days is sufficient. In the Sahel Region it is necessary to irrigate every 2 to 3 days in the height of the dry season.

The volume of irrigation will depend on the soil's water content and the crop's root development.
A well-established crop with deep root systems needs less frequent watering than a poorly established crop with shallow roots.

The amounts of water applied in each case therefore vary greatly: in the Sahel it is common practice to allow 6 mm of water every 2 to 3 days. In Europe recommended irrigation is 20-mm minimum and 40 mm maximum, although at greater intervals.

6- PLANT TREATMENTS

Often, no treatment is carried out, particularly in the Sahel where the risks of infestation are small, given the environmental conditions.

DISEASES:

-**Bean spot diseases** (colletotrichum lindemuthianum): black marks on leaf stalks and veins. Yellowing and shedding of leaves. Usually occurs in Humid Tropical Uplands during cool periods.

Control: all the varieties listed above are resistant to this disease.

-**Blights**: caused by bacteria (Pseudomonas and Xanthomonas). Xanthomonas blight is usually found in low Altitude Tropical Regions.

Control: some varieties are resistant to Pseudomonas blight (Royalnel). Copper based treatment products seem to slow the bacterial infection.

*The seed varieties listed are delivered free of the two diseases mentioned above. Contamination, particularly blight, is in variably of local origin.

- **Bean rusts** (Uromuces Phaseoli): affects the foliage, causing small yellowish blisters later turning rusty brown, in the center of a yellow halo. Bean rust leads to a drying out and shedding of leaves, which is fairly common in West Africa.

Control: treatment with Manebe/Mancozebe.

- **Root rot** (Pythium sp. Fusarium sp.): produces a rapid withering at the two leaf stage, brown rot in the roots and root neck, and death of the plant. Usually in warm, humid seasons with damp soil in Tropical Regions.

Control: good drainage. Avoid excessive water. Plant in ridges to avoid contact between plantlet and water. Practice rotation cropping. Treat with Benomyl.

VIRAL DISEASES:

-**Viruses** are transmitted by insect bites (usually aphids) and sometimes in seed stocks. Checkered marks on leaves.

All the varieties listed above are resistant to Common Mosaic and Yellow Mosaic.

Control: chemical treatment to eliminate aphids.

INSECT PEST:

- **Caterpillar**: many types of caterpillar can cause damage to bean crops. They may eat leaves or pierce holes in pods. The ‘Foreuse des Gousses’ (Pyrale) is particularly widespread in all Tropical Regions.

Control: treatment with acephate, dimethoate, endosulfan, and pyrethrinoides.

- **Mites**, **tiny spiders** which live in colonies on the upper surface of leaves, producing small discolored areas in the foliage and causing deformation of leaves.

Control: chinomethionate, endosulfan, and dicofol.

THREADWORM GALLS:

The bean plant is very sensitive to this pest. The threadworm gall is easily distinguished from the nodules of Nitrogen fixing bacteria, as latter are rounded and easily removed.

Control: rotation cropping, pesticide treatment.

The following program of plant treatment may be adopted in Tropical Regions:

-At the two leaves stage: copper based bactericide treatment and insecticide treatment;

-At the budding stage: copper and fungicide treatment;

-At the full flowering stage: copper and fungicide treatment;

7-GROWING CYCLE

After sowing, sprouting requires 5 to 7 days.

In a Tropical climate flowering begins 28 to 35 days after sowing. Depend on the earliness of the variety used, the pods will reach their full length 15 to 20 days after the blooming of the flower in question.

8- HARVESTING

All the techniques described above are valid for the majority of bean varieties. The big difference between ‘Filet’ varieties and other types (Mangetout, Stringless...) lies in the harvesting process.

Most failures in off-season export operations are cause by faulty harvesting:

The higher the percentage of good quality ‘extra fine’ grades (pods with a diameter under 6.5 mm), the greater will be the profitability of an export operation for ‘Filet’ type beans.

To obtain the desired qualities it is necessary to:

-Apply the techniques already described: a poorly cultivated bean tends to be ‘stringy’, it will be less tender and less fleshy. It will also be less straight and will be not store or travel well.

-Harvest everyday, or at least every two days, carefully picking beans one by one: beans which are missed will grow between harvesting operations, become unmarketable and reduce the production period by halting flowering prematurely. Harvesting every 3 or 4 days, which is common practice in Tropical Africa, should be completely ruled out, giving as it does a very high proportion of ‘ Fine’ and ‘Medium’ grades.

Such a rhythm of harvesting is only appropriate for ‘Mangetout’ varieties (‘Bobby’).

- To prevent the laborer breaking off flowers when moving a basket, he should be equipped with a small bag of non- fibrous material attached to his belt, which can be emptied into a field container at the end of each row.

To obtain beans of even quality it is preferable to harvest in the cool of the morning, or possibly the evening.

-Each harvesting operation should be followed by irrigation to give the ground time to dry before the next operation. Lack of water leads to hardening, characterized by the presence of threads, which reduces the value of the produce. Regular watering produces more tender beans.

*Flowering will last longer if beans are harvested younger. The harvest period may last between 8 to 20 days, depending on the variety used:

Short harvesting period: Orex - Finbel - Garonel
Extended harvesting period: Monel - Royalnel - Reginel.

The number of harvesting operations will depend on the length of the harvest period, varying from 3/4 to 10.

For varieties with extended harvest periods like Royalnel and Monel it is advisable, in the Sahel, to stop harvesting after 7 operations, as later harvesting tends to produce crooked beans.

9- NORM FOR GRADING AND YIELDS

It is meaningless to state a yield for 'Filet' beans without specifying the grade, since the larger the grade chosen the heavier will be the final yield. A yield of 12 tons per hectare made up of 100% medium grades will be completely not exportable (the beans will be full of threads), whereas a yield of 5 tons per hectare made up of 70% extra fine and 30% fine will give a good return.

For the export of fresh produce, beans are divided into three categories:

Medium: diameter greater than 8 mm
Fine: diameter between 6.5 mm and 8 mm
Extra fine: diameter of 6.5 mm or less.

For canning and freezing purposes the following categories are applied:

Extra fine: diameter of 6.5 mm or less, with a tolerance of 8% for canning, 20% for freezing - 1% by weight maximum of beans with threads.

Very fine: diameter between 6.5 mm and 8 mm
Fine: diameter between 8 mm and 9 mm
1/2 fine: diameter greater than 9 mm

Using the best types of 'Filet' bean now available, a total commercial yield of 6 to 7 tons per hectare with 80% of extra fine grades can be achieved, if the crop is well cared for and harvesting is carried out regularly.

Off- season producers in Tropical Regions because of technical problems and poor harvesting practice rarely achieve such commercial yields.

As an example, the following results have been obtained on average in a number of countries of West Africa and the Sahel. Most exporters calculate the yield as a ratio of beans harvested in kg to the quantity of seeds distributes in 1 kg.

This ratio often reaches 100, meaning that for each kilogram of seeds distributed and sown, the exporter receives 100 kg of beans. Some exporters lay down a minimum return for their producers of 60 kg of beans for every 1-kg of seeds.

In agronomic terms, given a sowing density of 80 to 100 kg/ha, this level of production corresponds to yields of between 8 to 10 tons/ha (with an imposed minimum of 5 to 6 tons per ha). Such yields are much too high for ‘Filet’ type beans and reflect deficiencies in harvesting and management. This is also revealed by the outputs achieved in each category:

- Sorting rejects: - 10 to 20%, i.e. 1 to 2 tons per ha lost

- ’Medium’ grades (over 8 mm): 10 to 20 % i.e. further 1 to 2 tons/ha lost or marketed at very low prices to local buyers. This category is practically inedible because of threads.

- ’Fine’ grades (6.5 to 8 mm): 50 to 60%, i.e. 4 to 6 tons/ha for export at middling prices if the market is well supplied or good prices at times of short supply and strong demand.

- ’Extra fine’ grades (less than 6.5 mm): - 25 to 30%, i.e. 2 to 3 tons/ha for export at excellent prices if quality is good, that is to say tender, fresh, stringless and straight.

The commercial export yield thus amounts to 6 to 8 tons per ha with 50 to 60% ’Fine’ grades and 25 to 30% ‘ Extra Fine’.

The financial return on exports would be much better if the total commercial yield was lower - from 5 to 6 tons/ha - with 70 to 80% ‘Extra Fine’ and 20 to 30% ’Fine’ which is, technically speaking, perfectly feasible in Tropical Countries.