

No-till french bean production technology

for maize fallow in north-east India

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Monocropping of maize (Zea mays) is prevalent practice in north-eastern region of India, as a second crop after rainy season. Maize crop harvest is not possible due to low soil moisture status and lack of irrigation facilities. Sloping land topography, conventional tillage and residue removal/burning further accentuate the problem of soil moisture conservation. However, a second crop of short duration in nature can be raised with adequate conservation effective cultivation practices. French bean (Phaseolus vulgaris) is a short duration crop and cultivated both for seed and green pods. It is a high value crop having very good market demand. Pre-ponding maize sowing time to end of April to beginning of May along with adoption of no-till cultivation practice and adequate residue management allows successful cultivation of french bean after maize.

Key words: *Phaseolus vulgaris*, Production, Technology, *Trichoderma harzianum*, *Zea mays*

MAIZE (*Zea mays*) is the second most important cereal crops after rice in the north-eastern region of India. The crop is mostly cultivated in uplands and sloping land as maize is sensitive to water-logging. After maize harvest the land remains mostly fallow due to lack of soil moisture and irrigation facilities leading to low cropping intensity and productivity. However, with the adoption of adequate package of practices and short duration varieties, crops like french bean (*Phaseolus vulgaris*) can be cultivated in maize fallow areas of the region. French bean is one of the most prominent and highly profitable legume crop grown in the north-eastern region of India. It is grown for its tender pods, shelled green beans and dry beans (*Rajma*) which are highly demanded in the local market. Green pods (100 g) contain 1.7g protein, 4.5g carbohydrates, 221 I.U. vitamin-A, 11 mg vitamin-C, 50 mg calcium, and dry beans that are rich in protein. The crop is relatively less prone to pest and diseases and thus, most suitable for



Fig 1. Steps for no-till French bean production technology in maize fallow

cultivation under organic production system. Due to its short duration, french bean is suitable for cultivation in sequence with many crops such as rice, maize, vegetables etc. Therefore, growing of french bean will increase the income of the farmers as well as fulfill the nutritional requirement of the people. Cultivation of french bean under no-till in maize (*Zea mays*) fallow (after maize) is one of the technology developed by the ICAR Research Complex for North-Eastern Hills Region, Umiam, Meghalaya with the objective to retain maximum soil moisture with minimum soil disturbance. At the same time it

reduces the cost of cultivation, saves time and meets the increasing demands of green vegetables and pulses in the region. Even in *jhum* fields, french bean can be produced with no-till following adequate package of practices under rainfed conditions. Thus, no-till technology has potential to double the cropping intensity, enhances crop productivity and income of the farmers substantially.

No-till frenchbean production technology after maize

Maize crop is grown with a spacing of 60 cm × 20 cm following

recommended package of practices. The maize is sown between last week of April and first week of May in uplands and *jhum* lands, and harvested during first fortnight of August. After harvest of maize cobs, the maize stalks should be cut about knee height and leaving the lower about 0.75 m stalk standing on the ground (Fig. 1). This will provide initial support for climbing of french bean crop especially the pole type one. The top portion of the stalk should be used as mulch after sowing of french bean to conserve soil moisture. Two V-shaped narrow furrows in between two rows of maize are opened at a row to spacing of 30 cm (leaving 15 cm spacing between maize and french bean on both sides) using a manual furrow opener with minimal soil disturbance just after harvest of maize. In late sown maize, furrow can be opened before maize harvesting for timely sowing of french bean.

Soil and climate

French bean can be grown in all type of soil but well drained loamy soil with pH 5.0 to 6.0 is the best for obtaining higher yield. It can be grown even at low pH in north-eastern region. French bean can be grown round the year except in the winter (between November and January) in the hills region. Being a temperate legume, the climatic condition of this region is well suited for cultivation of french bean.

Land preparation

Land preparation is done through ploughing and leveling is avoided under no-till condition. Unwanted weeds are removed and the furrows are opened by furrow opener or hoe between the rows of maize. Well decomposed farmyard manure or vermi-compost should be applied uniformly on opened furrow.

Varieties, seed treatment and sowing

Selection of varieties is important according to location suitability. Pole type varieties such as Naga local, Meghalaya local, Manipuri and bush type such as Selection-9, Contender, Anupam etc. are promising varieties for the region.

Seed treatment is important for

prevention of seed-borne diseases. Seeds can be treated with *Trichoderma* at 8 g/kg or Thiram or carbandazim at 2 g/kg of seeds 24 hr before sowing to control mycoplasmal disease. Sowing is recommended with a seed @ 25-30 kg/ha and spacings of 30 cm × 15 cm for pole type and 40 to 50 kg/ha with a spacing of 30 cm × 10 cm for bush type.

The best time for sowing is:

Green pod (vegetable) purpose

February – March and August–September

Seed purpose

August – September

After sowing the seeds in furrow, cover the seeds with soil and farmyard manure mixture (2:1) for better seed soil contact.

Nutrient management

It is of 3 types:

Organic nutrient management: Under organic production system, application of well decomposed farmyard manure @10 tonne/ha + rock phosphate 150 kg/ha or farmyard manure @ 5 tonne/ha + vermicompost 2.5 tonne/ha + rock phosphate 150 kg/ha is recommended. Full dose of organic manure and rock phosphate should be placed in opened furrow at the sowing. Application of lime @ 500 kg/ha in furrow followed by mixing with the soil ameliorate soil acidity and enhances yield.

Integrated nutrient management: Reduced dose of fertilizers may be applied at 30:30:20 kg NPK/ha (urea 65 kg/ha, single super phosphate 187 kg/ha and muriatic of potash 33 kg/ha) along with well decomposed farmyard manure @ 5 tonne/ha. All the fertilizer materials are recommended to be used at the

sowing as basal dose. Application of lime @500 kg/ha in furrow is recommended for improving fertility and productivity of french bean.

Gap filling, thinning and mulching

Gap filling should be done immediately after germination.

Thinning should be done at 2-4 leave stage i.e. 12-15 days after sowing to maintain optimum plant population.

Mulching with maize debris and other locally available materials such as weeds etc will help to conserve soil moisture, reduce weed problems and enhance productivity.

Water management

Generally french bean is grown as rainfed crop in the region. Under no-till condition, it is grown with the residual soil moisture in maize fallow. However, under long dry spell, life saving irrigation may be given at critical stages such as vegetative stage, flowering and pod formation stage for higher yield and pod quality.

Irrigation in french bean depends upon the season and soil type. During dry season irrigation is given immediately after sowing for better germination especially when crop is sown from February to March as this time rainfall is scanty in the region. Thereafter, it should be given at 7-8 days intervals, if there is no rain. Sufficient soil moisture is essential prior to flowering and pod development stage.

Staking of pole type french bean

The bamboo stick or any locally available materials (1.5 to 2.0 m height) should be used for staking at 15 to 20 days after sowing to support the pole type french bean (Fig. 2).



Fig 2. Staking in pole type french bean after

Staking increases pod yield of french bean. Under no-till maize fallow staking requirement is reduced by up to 50% as the standing maize stalk provides support to the climbing bean plants.

Weed management

Weeding through cultural practices is safe and eco-friendly. Only light intercultural operations are carried out in french bean and earthing up is avoided. Weed infestation should be taken care and removed at the initial stage of the crop growth. Generally at the later stage the weed growth is suppressed by crop. Hand-weeding or hoeing should be given from 20 to 25 days, and at 40 to 45 days after sowing. Application of pre-emergence herbicide Pendimethalin @ 1.0 kg a.i/ha mixing with 500 litre water from 1 to 2 days after sowing and hand weeding or hoeing at 20 to 25 days after sowing and at 40 to 45 days after sowing are recommended for control of weed in frenchbean. In organic french bean production, hand weeding or hoeing on 25 days after sowing and 45 days after sowing are recommended for managing weeds. Mulching with maize stalk and other biomass also reduces weed problem.

Insect and disease management

Very low incidence of insects and disease damages are observed in french bean.

Insect management: The insects which infest the french bean are blister beetle, mites, pod borer, bean weevil etc. Blister beetle feeds on flowers, fruits and reduce the pod formation. Pod borer feed on the surface of the pods, bore into it and feed on the seeds. Plants infested by mite become etiolated and start dying due to sucking of sap from tender parts. Sowing of french bean after second week of August helps in avoiding infestation of blister beetle. Manual collection and killing of blister beetle is most effective and economical. Spraying of neem oil (0.2%) or Karanjin (Derisome- a plant product from *Pongamia glabra*) 0.2% after germination at 10-day-interval prevents mites and other pests.

Under integrated pest management if crops are heavily



Fig 3. Green pod and dry bean

infested, spraying of endosulphan 0.05% (140 ml Thiodon 35 EC) or Carbaryl 0.1% (200 g Sevin 50 WP per 100 litre of water) at flowering stage is recommended besides adoption of cultural practices.

Harvesting, threshing and storage

For vegetable purposes harvesting is done by multiple picking of the green or tender pods. First picking is usually ready by 45 days after sowing and thereafter 7 to 10 days intervals pickings are done (Fig. 3). Generally 3 to 4 pickings can be done for crop with 65 to 70 days duration. For dry bean purpose harvesting should be done when most of the pods are fully ripen and most of the remainder has turned yellow. For seed purpose, time of harvesting play an important role, as premature harvesting results in poor quality seed, while delayed harvesting may cause *in-situ* germination in heavy rainfall (Fig. 3). In pole type varieties, mature pods should be harvested twice. First harvesting should be done when two-third pods look dry and the second harvesting when 90% of the remaining pods look dry. In bush type varieties, harvesting can be done once because of their determinate growth and synchronization in pod maturity.

Tender pod yields of 5-10 tonne/ha is harvested depending upon crop duration, varieties and management practices. Seed yields of 1.25 to 2.0 tonne/ha are obtained for well managed crops.

For seed purpose, the harvested pods should be threshed after sufficient drying in the sun. The seeds which are shriveled, unhealthy or broken should be sorted out. After threshing, the seed should be dried

thoroughly in sunlight up to 10 to 12% moisture level. The seed should not be stored in moist and high temperature conditions. It should be stored in clean and well labeled gunny bags, earthen or steel bins for maintaining the viability and quality of seed.

Economics

French bean is valuable and remunerative crop. French bean 1 kg costs ` 100 for grain (*Rajma*) and ` 20/kg green pod for vegetable purpose. The french bean for seed purpose costs about ` 250/kg. The cost of cultivation of french bean is approximately ` 33,700/ha. The net returns of ` 84,750/ha (B:C ratio 2.51) can be obtained for green pod purpose. For dry bean (*Rajma*) the cost of cultivation is ` 36,360/ha. The net return is ` 66,930/ha (B:C ratio is 1.84). However, the net returns and B:C ratio varies with the market price.

SUMMARY

This technology helps in retaining soil moisture with minimum soil disturbance and at the same time reduces the cost of cultivation, save time and meet the increasing demand of green vegetables and pulses in the region. Thus, no-till technology has potential to double the cropping intensity, enhance crop productivity and income of the farmers substantially.

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