

Prepared by Stevenson Skeete

For a Field day on 28<sup>th</sup> September, at the ministry of Agriculture, food, Fisheries and Water Resource Management

### What are row covers?

Row covers are structures used to protect plants from undesirable factors such as insects and frost. They have been used extensively in temperate countries as a safeguard for unexpected drops in temperature. More recently newer fabrics are being used to grow pest-free crops. Some of the newer fabrics are very light and can be thrown over most crops as "floating covers" (no hoop supports).



In our climatic conditions our aims would be to reduce wind speed and heat stress, to shelter from rain and to exclude pests.

#### Why use row covers?

- Local farming is open to suboptimal/erratic climatic conditions (especially rain). We are seeing heavy rains in the dry season.
- There are many challenges from pests and diseases. Broad mites and bacterial spot are two difficult problems that tend to be associated with rainy conditions.
- Start-up cost for the typical greenhouse prohibitive to small scale farmers. A typical 30' by 90' greebhouse can cost from \$12,000 and up, not to mention installation and maintenance costs.
- Row covers are a flexible and small-scale friendly approach. Protected agriculture can be available to all scales of operation.

# Our past experience with greenhouses

There are 2 greenhouses at CARS. The results of work on greenhouse technology by the Food Crop Research department have proven the possibilities for intensifying and improving production.

• Empire lettuce was recommended for greenhouse production. The size (weight of 0.3 Kg) and quality was comparable to imported heads. Large heads of a consistent size were produced making it easily marketable. The empire cultivated in the greenhouse



was fully accepted by retailers as the local market is familiar with this variety



• In lettuce trials, not only were the heads larger than those typically grown in

**Sweet pepper** : FAR7200 (43.2 Kg/m.sq)and Baltasar(38.8 Kg/m.sq) were recommended as cultivars for greenhouse production (optimal yield from isreal/India is 37.5Kg/.sq)

• Sweet pepper plants grown in the greenhouse had up to **28 fruit on average** as compared to the typical 4 to 6 fruit/plant that would set in the open field conditions. The quality of these fruit was also higher and more uniform.

- Parsley and thyme grown in the greenhouse achieved greater biomass and had better overall quality.
- In the thyme trial the plants yielded about .09Kg/month at the start and reduced to .04/month after six months. The findings suggested that a 100x30 ft greenhouse could produce about 50kg per week.



Thyme grown in tunnel at CARS

- Triple Curl and Green River cultivars performed best among 4 parsley cultivars tested in greenhouse
- The problem of parsley dieback did not set in until about 6 months after planting. Normally in the field it is difficult to obtain more than 3 months of growth. Since the parsley dieback problem is largely due to moisture/drainage conditions, the benefit of being able to control soil moisture (tunnel environment) was clear.



There are clearly huge benefits to be obtained from growing some crops in the greenhouse setting. Much of the benefit has to do with being able to avoid exposure to rain and buffering against droughty conditions. However, the initial cost of a typical greenhouse can be a deterrent for many. This prompted the search for alternative approached to achieving protected cultivation.

## Our experience with row covers

#### Description of the cover



The covers were made as low tunnels from 20mm PVC conduit, insect screen and plastic to make them durable and mobile. Each structure was 1.7 m wide x 3.3 m long x 1.3m high. The upper arch was covered with clear plastic while the lower sides and ends had fine insect mesh (see figure 1).

Over the last year the structures have been tested in beans and hot peppers. Very encouraging results were seen in both crops.

#### Hot pepper

• Plants growing under the covers grew to about twice the height and canopy girth of the plants in the open and yield was superior.





• The early growth was pronouncedly better for the covered plants



Under cover the leaves looked healthier...no signs at all of bacterial spot and mite damage.

After fruit set began, fruit were set consistently at a rate of about 2 per node.

Plants in the open were riddled with bacterial spot, alternaria and mite damage, despite a steady spray program



The early growth of pepper plants determines how well the bear.... The better the growth, the better the bearing.



 Leaves on covered plants were noticeably free of mite damage and bacterial spot.



Fruit were more numerous on the covered plants (73 per plant average vs 6 per plant)

Fruit quality was better as well on covered plants (more glossy, less blemishes) and fruit were larger on average (12.6g vs 7.4g)



# String beans

Two trials were done and in both produced the same results:

- There was a 50% increase in yield of bean plants under the covers
- The bean plants matured faster and set fruit earlier.



All fruit and flowers removed from sampled plants at 37 days after planting

## Description of the microclimate within the covers

- 70% shading of PAR
- Air Temp lower (by 1 degree)
- Soil temp lower (by 2 deg.)
- Reduced wind speed
- Increased soil moisture in top 5 cm
- Increased RH

#### A note on pollinators

One problem when fine insect mesh is used, is that pollinators cannot get in. This may affect fruit set. It did not seem to set back the beans, but for pepper it was necessary to open the sides to let the pollinators in. Bees and several different size flies were observed to visit the flowers.

Some advantages of using row covers:

- Improved yield and fruit quality
- Better production in wet season (less seasonality)
- Protection from wind stress
- Protection from heat stress
- Reduced incidence of moisture-loving pests and diseases
- Reduced use of pesticides
- Initial cost is lower (coverage can be increased)
- Lower cost per sq foot than a full scale greenhouse structure.
- Flexible- can be moved around and cover materials can be varied

## How to set up row covers in field

What's needed (what do you want to exclude? Rain, insects? )

Materials

- 20mm PVC conduit/ brickforce"/1/4 inch BRC/ stiff wire if very low tunnel
- Rebars/, wild tamarind/, bamboo/, reed/
- Insect screen. Bird netting, shade netting, fish net, greenhouse clear plastic
- Wire
- Tools- Power drill, hammer, nylon line, scissors, hack saw

Use a rod or template and nylon line to lay out the hoops. PVC Hoops can be spaced at 5 feet.

Align and drive in the rebars leaving 12inches above the ground.

Each pair of rebars will be 4 feet apart. Pairs of rebars are placed every 5ft along the bed.



Make a hoop by pushing the ends of the conduit over each pair of rebars. Hoops are therefore placed every 5 ft along the bed





Drill 3 small holes in each conduit, positioned as shown, and spool three lengths of wire through as above. Tie the wire ends to the anchors.

This completes the basic frame. The covering (insect screen, fish net etc) is thrown over this and clipped on.

# Cost of the covers

The cost of such covers depends a lot on how they are constructed. The ones used here were built for durability/flexibility and to avoid the dismantling/reconstruction process each time they had to moved. In the open field, longer covers would be better built with simple hoops forming a low tunnel/ hoop-tunnel. It is also possible to use light materials and make a "floating" cover.

The cost for the ones in the trial is approximately \$160. This could be broken down as follows:

Insect mesh 12 x10ft	100.00
Greenhouse plastic	30.00
PVC conduit (20mm.or 1/2 inch)	25.00
Drywall screws	5.00
	Insect mesh 12 x10ft Greenhouse plastic PVC conduit (20mm.or 1/2 inch) Drywall screws

The larger portion of the cost is for the insect screen and plastic and these should be sourced for the best pricing. This pricing above works out to about \$3 per sq ft. A 30x90 greenhouse at \$18000 works out to about \$6.60 per sq. ft. when constructed with a series of hoops and with the right pricing on materials the cost could be under \$2 per sq ft.

The intention over time is to source and try the cheaper woven polypropylene fabrics that are available. Some of these could greatly reduce cost if they prove effective in the local environment (especially durability).

When the construction is done as a series of hoops, only 2 PVC conduit lengths are used for each additional 10 ft. Other materials such as wild tamarind, bamboo, wild cane etc can be used to limit costs on a small scale.

When thinking of costs, one should bear in mind that the covers will be used several times and so the cost per crop would be a fraction of the construction cost. The covers were used 3 times already and so the cost per use is already down to just over \$50. The benefits and increased yield are very favourable compared to the cost.

The advantage here is that one can start small and gradually increase coverage.

## The way forward

- Minimising the cost of materials. Sourcing cheaper materials and testing them in our conditions e.g agribon, different types of hoops etc
- Trying a range of crops under the cover- cabbage, tomato, lettuce, thyme, parsley, sweet pepper.
- On farm trials
- Factorial trials to combine other factors such as foliar fertiliser and mulches
- Dealing with pollination

For further information on recent greenhouse and organic farming research, visit the food crop dept section of the knowledge centre of the Ministry's website:

#### www.agriculture.gov.bb