# Use of Row Cover in Cantaloupe (*Cucumis melo* L.) to Delay Infection of Aphid-transmitted Viruses in Honduras[1]

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## ABSTRACT

The yield response of cantaloupes grown under Reemay[r] row cover until female flower appearance was evaluated at La Granja, El Palenque, Los Patos and Monjaras, Department of Choluteca, Honduras, during the second planting of the 1992-1993 season. Covered cantaloupes produced a significantly higher yield (274 boxes/ha) than the uncovered cantaloupes. Virus incidence in plants ranged from 9.9% to 21.0% in non-covered plots and 0.8% to 2.6% in covered plots. The viruses CMV, PRSV, SqMV, WMV-2, ZYMV and Geminiviruses were detected in all three localities. Plants with symptoms of viral infection were first observed 6, 3, 6 and 4 weeks after planting in the noncovered plots at La Granja, El Palenque, Monjaras and Los Patos, respectively. The covered plots at Los Patos did not have plants with visual symptoms of virus. At the other localities, symptoms were first observed 6 weeks after planting. Vegetative growth in the covered plants was significantly higher than that of non-covered plants. Although row cover use was not economical in this study, adjustments in crop management may help to increase production to yields that would make its use profitable. Added benefits may be reductions of pesticide use and pest and virus *inoculum* build-up.


Key words: Insects, potyvirus, cucumovirus, cucurbits, floating row covers, disease prevention.


## COMPENDIO

Se evaluó el rendimiento de melones cultivados bajo cobertura flotante hasta la detección de flores femeninas, durante el segundo ciclo de siembras de la temporada 1992-1993, en La Granja, El Palenque, Los Patos y Monjarás, Departamento de Choluteca, Honduras. Los melones cubiertos tuvieron un rendimiento significativamente más alto, de 274 cajas por hectárea más que los descubiertos. La incidencia de virus varió entre 9.9% y 21% en los lotes descubiertos y 0.8% y 2.6% en los cubiertos. En estos últimos, las primeras plantas sintomáticas se observaron en un promedio de tres semanas después de retirar la cobertura. El crecimiento vegetativo de las plantas cubiertas fue más elevado que el de las descubiertas. Aunque el uso de las cobertura no fue económico en este estudio, los ajustes en el manejo del cultivo ayudarían a incrementar los rendimientos para que su uso sea rentable. Son posibles los beneficios adicionales, como reducción en el uso de pesticidas e incidencia de plagas y virus.


Palabras claves: Insecto, potyvirus, cucumovirus, cucúrbitas, coberturas flotantes, prevención de enfermedades.

## INTRODUCTION

Aphid-transmitted viruses reduce yield and quality of cantaloupes throughout the world (Blua and Perring 1989; Purciful *et al.* 1984; 1984). In Honduras, during the 1989-1990 melon growing season, approximately 50% of the expected yield was lost. The principal factor responsible was aphid-transmitted viruses (Espinoza 1990).

Cantaloupes for export are grown in southern Honduras in two plantings: November 1-15 and January 15-31. Although disease incidence is often low in the first planting, the second planting may be affected due to the inoculum and vector build-up. In areas of high disease frequency, fruit yield and quality are related to the age of the plant at infection. If infection can be delayed until fruits have set, yield and quality are not significantly affected (Blua and Perring 1989). Several spun-bonded polyesters,

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originally developed for frost protection of vegetables, also provide additional protection by excluding insects (Natwick and Durazo 1985). The mesh size of these materials is sufficient to allow light and air transmission, yet small enough to exclude aphids and other insects from the plants (Perring *et al.* 1989). One of these products, Reemay (Ken-Bat Products Reading MA), weights only 20 g/m², which allows for its use without ant support, hence the name floating row covers.

The objective of this study was to examine the effect of a row cover on yield and quality of cantaloupes by delaying the onset of insect-borne viruses in southern Honduras.

## MATERIALS AND METHODS

Cantaloupes were direct-seeded on January 25-26 and February 15-17, 1993 at El Palenque (cv. Hymark), La Granja (cv. Hymark), Los Patos (cv. Caravelle) and Monjaras (cv. Caravelle), respectively, Department of Choluteca, Hond. The field at La Granja was furrow-irrigated, whereas in the other fields melons were grown with residual moisture. In the locations where residual moisture was used, the herbicide ethalfluralin was applied at a rate of 1.68 kg AI/ha and the row cover placed immediately after seeding. Approximately 10 cm of the edges of the 1.70 m-wide fabric were buried with soil to prevent dislodging of the cover by the wind. A band of approximately 1 m was covered, leaving enough slack for plant growth.

At first detection of open female flowers 28-30 days after planting, the row cover was removed. At La Granja, herbicide was applied immediately after planting, but the cover was placed three days after the first irrigation, approximately four days prior to plant emergence

The experiments were established in commercial fields. Fertilization, pest management and other field management practices were conducted by the growers, according to their programs. Plot design at El Palenque, La Granja and Los Patos was a randomized complete block with four replicates. Each plot consisted of one row, 10 m long, with 3 to 4 plants/bed-m and 1.83 m between rows. Reemay® (Ken-Bar Products, Reading, MS) polyester row cover was compared to an uncovered control. The study at Monjaras consisted of a single plot of three 20 m-long rows covered with Reemay. At harvest, two 10-bed-m samples were taken from each of the two outer covered rows. Each sample from the covered rows was paired with a 10-bed m of the uncovered adjacent row.

Aphids were monitored with green ceramic tile traps. The 10.1 x 10.1-cm tiles (DAL 22 by DAL-TILE Corporation, Dallas TX) were placed in a clear plastic sandwich box, 12 x 12 x 3 cm, and filled to 0.5 cm from the top with ethylene glycol (Raccah and Irwin 1988). At El Palenque and La Granja, two traps were placed in beds adjacent to the experiment. At Los Patos and Monjaras, five traps were placed in each field, one in the approximate center of the field and one in the approximate center of each quadrant. Trapped specimens were collected weekly and preserved in 70% alcohol for counting and identification.

All plants in each plot were examined weekly for virus disease symptoms, i.e., mosaic and leaf distortion. Development of aphid colonies was also monitored weekly by examining 20 randomly selected leaves in each plot and counting aphids per leaf. Samples of diseased plants were taken from each field and assayed for cucumber mosaic virus (CMV), papaya ringspot virus (PRSV), watermelon mosaic virus 2 (WMV-2), zucchini yellow mosaic (ZYMV) and squash mosaic virus (SqMV) using ELISA (Matthews 1991), and for geminivirus using a DNA hybridization test (Brown 1989). Cantaloupe yield was determined as follows: the marketable fruits in each plot, those with regular spherical form and consistent net formation, were graded by size (9, 12, 15, 18 and 23), based on the number of fruits that fit into the standard 18.2-kg box used for packing. The yield of each melon size was converted to boxes/ha. The number of boxes of all sizes were added to obtain the total yield in boxes/ha. Fruit yield at each location was estimated following the procedure previously mentioned in five randomly chosen samples of 10-bed m. At La Granja, vegetative growth was evaluated at harvest by measuring and adding together the length of all the vines of five randomly chosen plants from each plot. Data were analyzed with the SAS PROC ANOVA and LDS tests (SAS Institute 1985).

## RESULTS AND DISCUSSION

The cotton aphid, *Aphis gossypii* Glover, was the most common aphid species trapped at each location.

Of the total of 226 aphids trapped from all fields, 86% were *A. gossypii*. The citrus aphid, *A. citricola* van der Goot, represented 13% of the total capture. Only one specimen of the green peach aphid, *Myzus persicae* Sulzer, was captured at Los Patos. All three species are vectors of CMV, PRSV, WMV-2 and ZYMV (Blackman *et al.* 1984; Lisa and Le Coq 1984; Purciful *et al.* 1984a; 1984b). The average count of aphids/trap/week was below five for any week during the study except at Monjaras, where counts varied from 2 to 22 aphids/trap/week (Fig. 1).

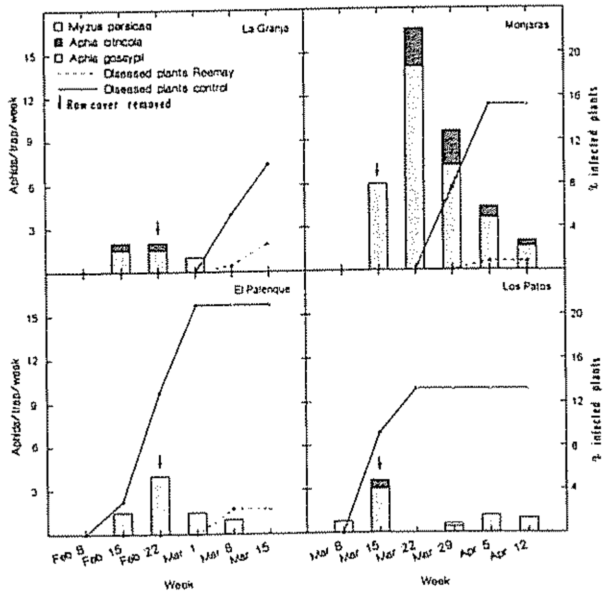


**Fig. 1. Average count of aphids (Aphids/trap/week) trapped in fields and virus incidence (%) in cantaloupe plantings with or without Reemay® row cover in four locations in Honduras (1993).**

La Granja had the lowest number of trapped aphids; *A. gossypii* was trapped from February 8 through March 1, whereas *A. citricola* was trapped from February 15 to 22. At El Palenque, *A. gossypii* was the only species trapped. At Los Patos, *A. gossypii* was trapped from March 8 through April 12; however, there no aphids trapped in the week of March 22. At Monjaras, *A. gossypii* were trapped from March 16 through April 13, with a peak of 14 aphids/trap/week in the week of March 23. *A. citricola* were trapped from March 23 through April 13 (Fig. 1). Although alates were trapped, aphid colonies (one or more apterae) were not found in any field throughout the season.

The incidence of plants with virus disease in the covered plots was significantly lower than that in the noncovered ones. The percentage of plants with visible symptoms in the noncovered plots ranged from 9.9% to 21.0% among the four sites (Fig. 1). The percentage of plants with visible symptoms in the covered plots was 0.8%, 2.3% and 2.6% at Monjaras, El Palenque and La Granja, respectively (Fig. 1). The first plants with mosaic symptoms in the uncovered plots were observed 3, 4, 6, and 6 weeks after planting at El Palenque, Los Patos, La Granja and Monjaras, respectively (Fig. 1). The covered plots at Los Patos did not have plants with visible symptoms of viral disease. At the other three localities, symptoms were first observed six weeks after planting.

Virus assay of symptomatic plant samples yielded different combinations of multiple infections with CMV, PRSV, SqMV, WMV-2, ZYMV and geminivirus. Zucchini yellow mosaic virus was the most frequently found virus in all locations; it was detected in 92% of the samples collected. Single virus infections were only found at Los Patos in 9.1% of the diseased plants; the rest of the samples from all localities had mixed infections of two or more viruses. Infections with all six viruses assayed were found only at Monjaras in 4.3% of the diseased plants

In general, an increase in the count of uncovered plants with symptoms of viral infection was observed one week after the increase in aphid collection (Fig. 1). The highest incidence of virus was observed at El Palenque, in spite of the relatively low count of aphids trapped. This may be explained by the field being located directly downwind from a watermelon field with no pest management. Diseased plants in this field likely served as a source of virus *inoculum*.

The vegetative growth and yield differed between covered and uncovered plots. The growth in the covered plots averaged 13.45 m of vire length in five plants, significantly higher ($p = 0.0001$) than that of the uncovered plots (8.06 m). The yield from covered plants was significantly higher ($p = 0.0053$) than that of uncovered ones, with an average difference of 274 boxes/ha. The estimated yields for each field were similar to the ones observed in the control plots at Monjaras and El Palenque. At Los Patos and La Granja, the average yield for the control was higher than estimated for the field (Fig. 2). There were several factors that prevented maximum expression of the benefits of using the row cover. At La Granja, the field was subjected to severe windy conditions for about 12 days during blooming, which prevented adequate bee pollination. At the other three localities, the hot and dry conditions of the dust mulch seemed to affect pollen viability, resulting in a low fruit set.

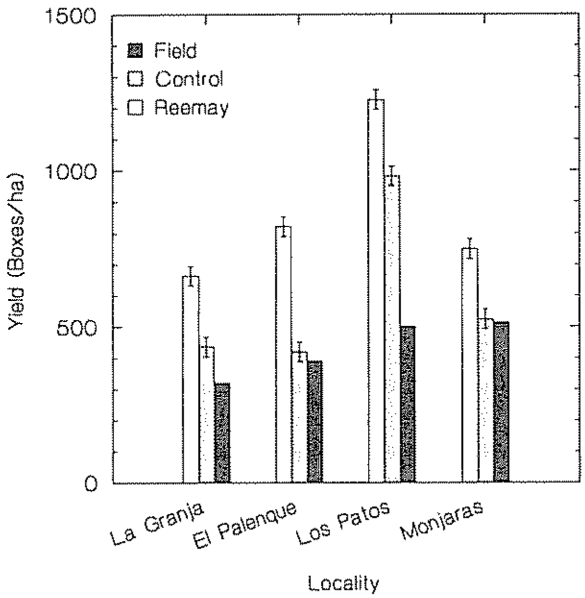


**Fig. 2. Yields of exportable cantaloupe fruit (boxes/ha +SE) for plants uncovered and covered with Reemay® until flowering, and estimation for all four fields in Honduras (1993).**

The application of Reemay® costs approximately US$2100/ha, which would require a minimum yield of 1000 boxes/ha to make its use profitable. Under the high-input management currently used, the yield for economic profit is approximately 700 boxes/ha. In 1992-1993, however, no yield in the study areas was this high (Fig. 2). Average yield for Honduras was only 711 boxes/ha during the 1992-1993 season (Ponce 1993). The reason for such low yields is not clear, but it seems that water stress is an important factor. Yields equivalent to 1953 boxes/ha have been obtained experimentally from cantaloupes covered with Reemay® and uncovered at first appearance of female flowers (Espinoza 1994).

The use of a Reemay® cover has the potential for increasing yields to make its use profitable. Adjustments in the current practices, such as one or two irrigations during blooming and fruiting, and others that improve conditions for the plants should be investigated to determine how they can be integrated with the Reemay® row cover to optimize yields.

At Santa Rosa, Department of Valle, another experiment was established, but it was abandoned because of abrasion damage to seedlings by Reemay blown by high winds. Melons were direct-seeded on ridges, and upon germination they were exposed to frequent abrasion caused by the wind moving the row cover back and forth over the seedlings. About 25% of the plants were killed, and the surviving ones were severely stunted. This problem could be resolved by planting seeds in a 10 to 12 cm furrow so that emerging plants will not come into contact with the row cover until they have 3 to 4 true leaves.

Besides the protection against early infection of viruses, the use of Reemay® can result in additional benefits, such as reduced need for pesticide application and reduced buildup of pest populations and virus *inoculum*. In the fields in which these experiments were conducted, 60% of an average of 14 pesticide applications per season were made during the first month. This 60% could be eliminated with the use of the row cover, reducing costs by US$260. This would bring the net cost of using the row cover down to US$1840/ha, which would require a yield for profit of 876 boxes/ha. If the row cover is used over an extensive area, a reduction in insect pests and virus *inoculum* build-up is expected. The reduction in the availability of host plants may further reduce the need for insecticides after removal of cover.

Based on the above considerations, Reemay® seems to be an attractive tool in melon insect pest and viral disease management, provided the implementation cost can be overcome with increased yields and reductions in pest populations and virus *inoculum*.

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