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THE EFFECT OF PLASTIC COVER ON TOMATO GROWTH IN THE RAINY SEASON

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ABSTRACT

Using tomatoes as the test crop, field experiments were conducted during the rainy season in 1981–84 to evaluate the usefulness of: (a) plastic bags placed individually over each plant, (b) black plastic mulch and (c) plastic covered sheds. It was found that the plastic bags over each plant increased vegetative growth but retarded fruiting, thus depressing yield. (b) and (c) either had no significant effect or they both equally increased yield. Wet season yields from the same field could be as low as 13% of the dry season yield.

RESUMEN

Experimentos de campo usando el tomate como el cultivo experimental, se llevarón a cabo durante la estación de lluvias en los años 1981–84, con el objeto de evaluar la utilidad de lo siguiente: (a) bolsas plásticas colocadas individualmente sobre cada una de las plantas, (b) plástico negro alrededor de las plantas, (c) cobertizos cubiertos de plástico. Se encontró que las bolsas plasticas colocadas sobre cada una de las plantas incremento el crecimiento vegetativo pero, retardo la fructificacion, por lo tanto el rendimiento fue menor. Los puntos b) y c) o no tuvieron un efecto significativo, o ambos de los usos incrementaron la producción, igualmente. Los rendimientos del mismo terreno, durante la estación de lluvias, fueron a veces menos en un 13% que el de los obtenidos durante la estación de sequia.

Keywords: Tomato, Wet season production, Plastic covers.

The large price increases of vegetables normally experienced during the wet season are an indicator of the low yields obtained. This is particularly true of tomato which is the most popular vegetable grown in the Caribbean.

The major factors limiting its growth in the wet season have been identified as: (i) high minimum temperature, usually 21 °C, which is too high for fruit set in most imported varieties; (ii) high humidity coupled with high temperature leading to greater incidence of pest and disease damage; (iii) adverse effects of temperature on metabolism; (iv) prolonged cloudy periods which reduce photosynthetic activity and (v) heavy rainfall which can cause damage to young shoots and flowers (Charles, 1981).

Of the five factors, probably the adverse effects of heavy rainfall are most amenable to control. Wilson (1979) showed that mulching and fertilization can significantly increase yield.

Increasing the yield of tomatoes in the wet season has become a major preoccupation in Trinidad. Farmers are constantly asking for advice on improving yields. Therefore, data on the simplest systems to the most sophisticated are needed.

The experiments reported here are the first in a series to be conducted to acquire such data. Only the simplest methods of controlling the effects of heavy rainfall were considered:

(a) covering each plant individually with plastic and

(b) covering the soil either with a plastic mulch or with a clear polythene covered shed.

Materials and methods

Between late 1981 and 1984 a total of five experiments were conducted. Experiments I, and III–V were conducted at El Carmen Experiment Station, Centeno. The soil is classified as an Aquatic Eutropept (USDA classification), and is a fine sandy clay with restricted drainage and shallow rooting depth. Experiment II was conducted at La Pastora Demonstration Station, Santa Cruz where the soil is classified as a Fluventic Eutropept (USDA classification); a fine sandy loam, free draining and having moderate rooting depth.

In Experiment I, clear plastic bags (120cm x 69cm) were used to cover each tomato plant. Three covering intervals were used: (a) at planting, (b) at first flowering and (c) at first fruiting. The control treatment had no cover. Six replicates were used in a completely randomised design.

Experiments II–V were all similar in that either a black plastic mulch or sheds covered with ordinary clear plastic were used to cover the whole plot. The plack plastic was laid over the plot and at suitable invervals, holes were made to plant the seedlings. The sheds were 3m x 1m and 2m high, two being used per plot. Only the top half of each shed was covered with plastic to allow for ventilation and comfort whilst working.

The treatments for Experiments II–V were (i) no cover, (ii) black plastic mulch and (iii) plastic sheds. These treatments were replicated three times.

Three-week old seedlings of tomato variety, Walter were used at a planting density of 32,000 plants ha^{-1} for all experiments. This variety is considered to be well suited to wet season conditions. All plants were staked. In all five experiments, basal fertiliser (13:13:20) was applied at the rate of 1200 kg ha^{-1} in three, split applications. Dymid (N–N, dimethyl–2–2–diphenyl acetamide) was applied at 5–10 kg ha^{-1} to the weed-free area and this was followed by Toxiphene EC45 (chlorinated camphene) at the rate of 7.4g l^{-1}.

Results and discussion

Experiment I

The rainfall during this experiment was 451mm. Table I gives details of the yields of tomato obtained in Experiment I. No statistically significant differences, at the 5 per cent level, were found. The tomato plants were healthy throughout, only slight indications of bacterial wilt *(Pseudomonas solanacearum)* and blossom-end rot being found towards the end of the experiment.

Table 1 Mean yields of tomato plants covered individually with plastic bags at El Carmen. November 1981 - March 1982

Treatment	Yield per plant (g)	Estimated yield ha^{-1}
No cover	436	13,968
Covered at planting	231	7,398
Covered at flowering	450	14,390
Covered at fruiting	380	12,154
L.S.D. 0.05	346	

The lowest yield obtained was from plants covered at planting. This was due to retardation in fruit set and smaller fruit size. These plants grew very tall. There were two harvests. In the first harvest only one plot in this treatment had harvestable fruit; in the second, four out of the six plots had fruit.

The effect of temperature on fruit set and flowering is well known. Aung (1978) showed that temperatures of 26–30°C can increase vegetative growth and delay flowering.

An important factor in all the experiments was seedling survival after transplanting. A maximum of 50 per cent of the seedlings first planted survived to produce fruit.

It would seem from the results of this experiment that covering individual plants with a plastic bag has little or no advantage.

Experiment II

The rainfall recorded at La Pastora during the experiment was 354.8mm.

The yields obtained in this experiement are presented in Table 2. This field is well known to be infected with nematodes and the yields reflect this. There was wide variation not only between treatments but for plots of the same treatment.

Table 2 Mean yields of tomato plants grown on plastic mulch or under plastic shelters at La Pastora. November 1982-March 1983

Treatment	Yield per plant (g)	Estimated yield (kg/ha)
No cover	438	13910
Black Plastic mulch	1105	35376
Polythene sheds	716	22915
LSD 0.05	750	

Of the four replicates only one produced any fruit in the control treatment. This can be attributed in part of the adverse effects of heavy rainfall.

All the mulched plots produced fruit for three out of four harvests. In the fourth harvest only one plot had fruit. The plots covered with sheds had fruit in all four harvests. In this case, however, they were fewer and/or smaller than those in the mulch treatment.

Although the differences between the total yields for each treatment are large, they are not statistically significant at the 5 per cent level. It appears that the incidence of nematodes and/or other factors had a greater effect on yield than the treatments. It will require further investigation to elucidate the factors involved.

Experiments III–V

The yields obtained in Experiments III and IV were considerably depressed compared with those in Experiments I and V. In Experiment III this can be attributed to the much heavier rainfall since this soil is liable to waterlogging. Few plants produced fruits. There was little incidence of disease.

Analysis of the derived data to $\log_{10}$ from Experiment IV showed that the differences between the control and the two types of cover are significant at the 5 per cent level. Both mulching and covering with a shed increased yields to the same extent. This is the only experiment in which there was a statistically significant difference between yields. The yield in the control plot in Experiment IV was the lowest of the whole series of experiments.

Experiment V, is essentially, a dry season experiment conducted to give base data for all the other experiments conducted on this site. Comparison of the mean yields over all treatments in experiments III and V shows that the wet season yield can be as low as 13 per cent of the dry season yield. Therefore, there is considerable room for improvement.

Table 3 Rainfall and mean yields of tomato plants grown on plastic mulch or under plastic at El Carmen, 1983-1984

Expt.	Period	Rainfall	Yield (kg/ha)			
			Control	Mulch	Shed	LSD 0.05
III	6/83-10/83	1420.3	1868	1855	2554	1431
IV	11/83-1/84	684.0	756	3288	3726	3710
V	4/84-7/84	377.1	15271	15042	18292	8989

The evidence that black plastic mulch and clear polythene sheds as covers improve yield in the wet season is not conclusive. In one experiment only, out of four, did they increase yield significantly. Wilson (1978) and Horavitch and Churata-Masca (1982) showed that mulching with organic and plastic mulches, respectively, increased yield. It is not possible from the results of these experiments to say which type of cover, mulch or shed, would be the more beneficial.

Conclusions

1. Covering individual tomato plants with plastic bags had little or no effect on tomato yields.
2. Mulching with black plastic or polythene covered sheds only increased yields significantly in one experiment out of four.
3. Wide variation in yield obscured any differences due to the type of cover. The causes of these variations need further investigation, e.g., incidence of disease and the effect of temperature on flowering and fruit set.

References

Aung, L. H. (1978). Temperature regulation of growth and development of tomato during ontogeny. *1st International Symposium on Tropical Tomato.* AVRDC, Taiwan.

Charles, W. B. (1981) *Tomatoes.* Crop Bulletin **1 – 10,** Ministry of Agriculture, Lands & Food Production, Trinidad.

Horavitch, P. and Churata-Masca, M.G.C. (1982). Effects of support systems and mulches on tomatoes of determinate growth for fresh market. *Proc. Trop. Region, Am. Soc. Hort. Sci.* **25,** 457–459.

Wilson, G. F. (1978). The effects of *in-situ* mulch on tomato production. *1st International Symposium on Tropical Tomato.* AVRDC, Taiwan. 1978.