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EFFECT OF ORGANIC AND SYNTHETIC MULCH (REFLECTIVE AND NON REFLECTIVE) ON YIELD OF SCOTCH BONNET HOT PEPPER

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ABSTRACT: Field studies were conducted at the Famu research farm at Quincy, Florida, during the 1999 and 2000 growing seasons to examine the effect of organic and synthetic mulches on the yield potential of Scotch Bonnet hot peppers *Capsicum chinense*. For the 1999 study, only 2 mulches, one organic (Bahia grass) and one synthetic (black plastic) and a control (bare ground) were used. The 2000 study extended the synthetic mulches to white plastic and silver plastic (both reflective) and the organic mulches to perennial peanut and mushroom compost. For both years, the experimental design was a Randomized Complete Block Design with 3 replications. A drip irrigation system was installed to supply the moisture requirements of the crop. Weekly harvests were conducted to obtain data on yield parameters such as fruit size, fruits plant^{-1} and marketable fruits ha^{-1}. For the first year of the study, fruits from plots mulched with Bahia grass, were significantly larger ($P < 0.05$) than fruits from plots mulched with black and white plastic. However, none of the plots showed any significant differences in fruits plant^{-1} and marketable fruits ha^{-1}. In the second year of the study, With the exception of plots mulched with bahia grass, yield from plots mulched with organic mulches were significantly higher, $P < 0.05$ than plots mulched with black and white synthetic mulches and the control plots. However, marketable fruit yield from plots mulched with silver plastic was not statistically different ($P < 0.05$) to yield from organic mulch plots. Highest yield (2629 kg ha^{-1}) was obtained from plots mulched with mushroom compost. These plots also produced significantly higher yield ha^{-1} and fruits plant^{-1} compared to all plots with the exception of those mulched with perennial peanut and silver plastic. Plots mulched with black plastic produced significantly smaller fruits compared to all other plots.

INTRODUCTION

In the Southeastern United States, Florida ranks second to Texas, in terms of total acreage devoted to hot pepper production. While chemicals, including herbicides and inorganic fertilizers have been used with success to enhance yields, alternative cultural practices that are safe to human health and the environment, while at the same time maintaining high levels of crop productivity are needed (Relf, 1998). The useful effects of mulches in agricultural production are well documented. Benefits cited from the use of mulches include higher yields and better weed control (Hutchinson and McGiffen, 2000; Dale, 2000; Sanders et al., 1999) earlier maturity and fruit set (Tarara, 2000) reduced nutrient leaching and moisture loss, and improved fruit quality (Waterer, 2000).

More specific studies have focused on the influence of mulches on yield of horticultural crops. (Csizinszky et al., 1999) used a randomized complete-block design to evaluate the effect of ultraviolet-reflective mulches on tomato yields. They concluded that spring tomatoes grown on reflective mulches were larger and produced greater marketable yields, than those grown on non-reflective (black) polythene mulch. Using a randomized complete-block design, Hutchinson and McGiffen, 2000, investigated the effect of cowpea cover crop mulch on desert pepper production. They concluded that cowpea mulch provided greater fruit weight and promoted plant growth and fruit production

The objective of this study was to evaluate the yield potential of Scotch Bonnet hot peppers grown on synthetic mulches (reflective and non reflective) and organic mulches.

MATERIALS AND METHODS

Studies were conducted in Spring 1999 and 2000 on a Bonifay Sandy Loam soil at the FAMU research farm at Quincy Florida. In each study, treatments were arranged as a randomized complete-block design with three replications. Each treatment consisted of a 20-foot (approx. 1.0 m) strip within three 150-foot long raised beds spaced 3 feet apart. Twenty-foot strips of both white and silver plastic were laid over the existing black plastic while 20-foot strips of black plastic were removed for the purpose of laying the organic mulches. Mushroom compost treatments were composed of a mixture of approximately 3 parts soil to 1 part mushroom compost spread approximately 2.5 cm (1") to 5 cm (2") over the ground and mixed to a depth of approximately 12 cm (5") with the use of a spade and rake.

About 1.5 cm (1/2") to 2.5 cm (1") of the compost was allowed to cover the surface of the bed to complete the mulch. For the 1999 study, only 2 mulches: one organic (Bahia grass) and one synthetic (black plastic) and a control (bare ground) were used. The 2000 study extended the synthetic mulches to silver plastic and white plastic (reflective) and the organic mulches to perennial peanut and mushroom compost. For both years, the experimental design was a Randomized Complete Block Design with 3 replications. The soil was fumigated with Terr-O-Gas (66.6 % methylbromide and 33.3 % chloropicrin) at 224 kg ha^{-1} and a drip irrigation system was installed to supply the moisture requirements of the crop.

Two weeks after fumigation, 12-week old Scotch Bonnet seedlings that were grown in the greenhouse during the winter months were transplanted into the field. For Mature yellow fruits were harvested from a 36 square feet area of the center row of each treatment on a weekly basis, over a 17-week period, starting on August 15, and ending on November 15. Fruits were separated into marketable and cull, then marketable fruits were size graded on a weight basis by determining the number of fruits it took to weigh one pound (0.45 kg). The data were analyzed by analysis of variance (ANOVA) (SAS institute, 1988, version 8.0) General Linear Models Procedure. When significant F-values were found, differences between means were determined by using Duncan's multiple range test.

RESULTS

For the 1999 study, Bahia grass treatments produced significantly larger fruits with an average of 42 fruits to the pound, compared to black plastic with an average of 46 fruits per pound ($P < 0.05$). However, despite being numerically higher, yield ha^{-1} and $plant^{-1}$ were not significantly different compared to yield from black plastic treatments and the control (Table 1).

Table 1. Scotch Bonnet yield as affected by polyethylene and organic mulch in 1999

Treatment	Fruits/plant	fruit size	Yield (kg ha^{-1})
Bahia grass	50 a	42 b	3036 a
Black plastic	42 a	46 a	2441 a
Control	49 a	44 ab	2858 a

Means followed by the same letter are not significantly different, $P < 0.05$

For the 2000 study, all yield parameters (yield ha^{-1}, fruits $plant^{-1}$ and fruit size) were better for mushroom compost treatments. Fruits $plant^{-1}$ and yield ha^{-1} obtained from mushroom compost treatments were significantly higher than those obtained from all treatments with the exception of perennial peanut and silver plastic treatments. Except for black plastic treatments that produced significantly smaller fruits compared to all other treatments, fruit size was similar for both organic and synthetic mulch treatments (Table 2).

Table 2. Scotch Bonnet yield as affected by polyethylene and organic mulch in 2000

Treatment	Fruits/plant	fruit size	Yield (kg ha^{-1})
Mushroom compost	38 a	40 b	2629 a
Perennial peanut	33 ab	46 b	2150 a
Bahia grass	23 bc	42 b	1450 bc
Black plastic	10 d	64 a	504 d
White plastic	15 cd	46 b	905 cd
Silver plastic	32 ab	46 b	1974 ab
Control	16 cd	46 b	934 cd

Means followed by the same letter are not significantly different, $P < 0.05$

DISCUSSION

With the exception of silver plastic treatments, plants grown on organic mulches performed significantly better than those grown on synthetic mulches. Although preliminary, the findings of this study suggests that growing Scotch Bonnet hot peppers on organic mulch produces higher yields compared to synthetic mulches and bare ground treatments. Considering the great deal of emphasis being placed on environmentally friendly agricultural practices, the findings of this study provide a need to widen the scope of future studies, to determine how the use of mulches could optimize crop production in sustainable agriculture. Although the relative costs of using organic versus synthetic mulches were not covered in this study, the documented benefits of using organic substances as mulch may outweigh those obtained from the use of synthetic mulches. This issue poses another challenge for future research on the use of organic and synthetic mulches, not only for hot pepper production but also for other horticultural crops.

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