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COMPARISON OF MULCH TYPE EFFECT ON YIELD OF PARSLEY IN THE VIRGIN ISLANDS

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ABSTRACT. A study was conducted to compare the effects of various mulch types on the growth and yield of parsley (*Petroselinum sativum*). Parsley was planted in plots consisting of 3 rows spaced 40 cm apart and a length of 5 m. Plants were spaced 30 cm within rows. Mulch treatments included black fabric (weed barrier), silver film, white plastic, grass straw and a non-mulch treatment. The experimental design was randomized complete blocks with 4 replications. All plots were drip irrigated to maintain a soil moisture tension of 30 kPa. Data on plant height, fresh and dry matter yields were collected for each harvest. Weed population and weed weight were determined before each weeding operation. Results from three harvests indicated no significant differences among mulch treatments in terms of total fresh and dry matter yields but for the third harvest the straw mulch plots produced significantly higher yields of both fresh and dry parsley, compared to the weed barrier and white plastic, respectively. Overall, plants from the straw treatment were significantly taller than from other treatments except the non-mulch treatment. The effect of mulch on weed population, incidence of pests and diseases and water use will be discussed in this paper.

INTRODUCTION

Culinary herbs are important horticultural crops in the U.S. Virgin Islands. These crops are a major source of income for the many small-scale growers in St. Thomas and St. Croix. In spite of their economic importance little research has been undertaken to improve field production, processing and marketing of these crops.

Culinary herbs are grown and marketed fresh or dry. The preference on the local markets is for the fresh product but there is also a market for dried herbs.

Significant quantities of dried culinary herbs are imported annually into the U.S. Estimates by the USDA Foreign Agricultural Service showed that more than \$349 million of dried condiments, seasonings and flavorings were imported into the U.S. in 1988 (USDA, 1989). In recent years, consumption of culinary herbs and spices has steadily increased in the U.S. More Americans are consuming fresh, frozen, processed and dried culinary herbs and spices than before, and this trend appears to continue (Simon, 1990). Factors that account for increased consumption include interest in new foods and tastes, availability of more fresh herbs, advertising promotion by food services and institutional food chains, and expanding ethnic populations demanding foods and flavorings of their homeland.

The Caribbean Islands, including the U.S. Virgin Islands, have demonstrated the potential for commercial production of herbs and spices but more focused research need to be conducted for improving the production capability.

This establishes the need to develop sustainable crop management practices to improve production levels and enhance culinary herb production through the use of organic mulches, composts, green manures, intercropping and micro-irrigation.

Mulches are used to suppress weeds, reduce erosion, conserve soil moisture and modify soil temperature, structure, and aeration. These benefits translate into savings of energy, labor, water and herbicides. The most used mulch in the Virgin Islands is probably plastic film (polyethylene) mulches. Black mulch is popular among growers because it is easily available and has excellent weed control properties. A drawback to its use is the elevation in soil temperature, which though desirable in temperate areas may not be beneficial to all crops grown in the Virgin Islands.

Organic mulches such as straw acts to buffer soil temperature whereas synthetic mulches permit more divergent temperature fluctuations (Ashworth and Harrison, 1983) Palada et al., (1995) reported that organic mulches were found to reduce the daytime temperature of the surface soil by 2-5°C in the Virgin Islands.

Organic mulches provide additional benefits compared to synthetic mulches because they add organic matter and nutrients to the soil as they decompose and are incorporated into the soil after harvest.

In a study evaluating two organic and six synthetic mulches Ashworth and Harrison (1983) found that no single mulch produced consistently higher plant yield or better growth. The organic mulches reduced the range of diurnal temperature changes and maintained cooler temperatures from noon until evening.

The use of polyethylene in the virgin Islands has other drawbacks because it has to be imported into the islands which makes it expensive and not always readily available. There is also the environmental concern regarding disposal of used mulch. This task has been reported to be an unpleasant job that adds to the farms labor cost (Anderson et al., 1995). It adds to the landfill and may leave unsightly litter on the farm.

Positive responses of vegetables to mulch and irrigation have been reported by many researchers (Ashford and Harrison, 1983; Bhella, 1988a; Bhella 1988b; Bhella and Kwolek, 1984; Locascio and Myers, 1974; and Sweeney et al., 1987).

Research conducted on culinary herbs in the Virgin Islands has provided some indications of responses to mulching. The application of black polyethylene mulch in combination with microirrigation resulted in reduced yields of thyme from the mulched treatments due to a higher incidence of soil borne diseases in the mulched plots (Collingwood et al., 1991; Palada et al., 1993a). In a comparison of synthetic and organic mulches Palada et al., (1995 and 1993b) and reported positive responses from the use of organic mulches.

The objectives of this study was to determine the effect of various mulches on yield of parsley; compare water use efficiency of parsley grown in mulched plots; observe the influence of mulches on weed growth.

MATERIALS AND METHODS

The study was conducted at the Virgin Islands Department of Agriculture, St. Croix. The soil is a Hogensborg fine, smectitic, isohyperthermic, sodic, haplustert. Treatments consisted of white on black polyethylene mulch, black fabric weed barrier, silver plastic film, grass mulch (hay) and a non-mulch treatment. All treatments included the application of

microirrigation. The irrigation system was comprised of 15mm polyhose submains (Hardie Irrigation, El Cajon, CA) and laterals of 15ml New Hardie Tape with laser drilled orifices spaced 30 cm apart.

The experiment was established using randomized complete blocks with four replications. Each treatment plot was 1.2 m x 3.6 m, consisting of three rows 0.4 m apart. Plants were spaced 0.3 m within the rows. All plots were irrigated to maintain soil moisture at 30 kPa. Tensiometers (Irrrometer, Riverside, CA) were installed in each plot of two of the four replications. Water meters were used to monitor water use by taking weekly readings for each treatment. Weed samples were taken from each plot prior to weeding. The fresh weight of the weed biomass was recorded and the samples were oven dried for dry matter determination. Fertilizer was applied to all treatments at the rate of 100 kg N, 50 kg P and 50 kg K/ha. Cow manure was used to provide 50 % of the N and urea, triple super phosphate and sulphate of potash to complete the required amounts of nutrients. Parsley seedlings were transplanted on December 13, 1996. The grass mulch treatment was applied on December 20, 1996. The data collected at each harvest were plant height and fresh weight. The harvested materials were then placed in an oven at 65 °C and dried to a constant weight for dry matter determination. The parsley was harvested a total of three times at intervals of approximately 30 days beginning on January 27, 1997.

Table 1. Plant height (cm) of parsley grown with various mulches in the Virgin Islands.

Mulch Type	Harvest #1	Harvest #2	Harvest #3	Mean Height
Bare	26 ab ^x	26 ab	23	24.4 ab
Weed Barrier	26 ab	23 b	22	23.7 b
Silver Plastic	23 b	25 ab	16	23.2 b
Straw	28 a	29 a	26	27.5 a
White Plastic	24 b	26 ab	22	23.8 b

^x Within columns, means followed by the different letters are significantly different by Duncan's multiple range test (P# 0.05).

RESULTS AND DISCUSSION

The height of the parsley plants was significantly affected by the application of mulches. Plants in the straw mulch were consistently the tallest of all treatments. The data in Table 1 showed that for the first harvest plants in the straw mulch treatment (28 cm) produced significantly taller plants than both the white and silver plastic mulches (24 and 23 cm, respectively). The straw mulch treatment plants from the second harvest (29 cm) were significantly taller than from the weed barrier mulch (23 cm). The mean plant height for the

three harvests showed that the straw mulch plots produced plants that were 27.5 cm tall and this height was significantly higher than plants from all of the other mulch treatments.

The significant differences in plant height observed for the first two harvests did not result in any significant yield differences, even though the straw and bare soil treatments had the highest fresh and dry matter yields for both harvests. However, the third harvest for which there were no significant differences in plant height was the only harvest for which there was significant yield differences (Table 2). The plants from the straw mulch plots produced a significantly higher quantity of fresh (811 g/m²) and dry (141 g/m²) than the weed barrier and white plastic, respectively.

Table 2. Fresh yield and dry weight (g/m²) of parsley grown with various mulches in the Virgin Islands.

Mulch Type	Fresh Wt. Harvest #3	Total Fresh Wt.	Dry Wt. Harvest #3	Total Dry Wt.
Bare	639 ab ^x	1589	127 ab	296
Weed Barrier	321 b	1266	79 ab	243
Silver Plastic	479 ab	1264	94 ab	226
Straw	811 a	1895	141 a	317
White Plastic	394 ab	1209	48 b	207

^x Within columns, means followed by the different letters are significantly different by Duncan's multiple range test (P# 0.05).

WEED COUNT

The data for number of weeds shows a significantly higher weed population in the bare soil treatment (15 plants/m²) which was significantly higher than from the white plastic mulch which had only 1 plant /m². The amount of fresh and dry weed biomass was however, similar for all treatments. The plots were weeded on a regular basis which prevented weed seedlings from getting big enough to accumulate any appreciable biomass. The weed population data gives an indication of potential weeds that would be encountered if plots are not weeded as often as they were in this trial.

Problems were encountered regarding the use of the silver mulch. A combination of rainfall and high temperatures caused mulch to lose the silver coating on a large percentage of the mulch. This caused light penetration through through the transparent areas of the mulch and contributed to a high weed population under the plastic mulch. The mulch also started deteriorating before the trial was terminated.

A root knot nematode problem also developed during the latter stages of the trial. The loss of plants caused by this pest ranged from 40 % (silver mulch) to 17 % in the straw and

non-mulch treatment. This higher nematode infestation in the synthetic mulch probably indicates that these mulches create a micro-environment that is ideal for the development of nematodes.

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