NOTA CIENTÍFICA

EFFECT OF SUNLIGHT REGIMES ON GROWTH AND YIELD OF PIQUIN PEPPER (*Capsicum annuum* L. var. *aviculare*)

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ABSTRACT

Effect of four light regimes of exposition (all-day, only morning, only afternoon, and all-day shaded) on piquin pepper (*Capsicum annuum* L. var. *aviculare*) growth and yield was studied in Río Bravo, Tamaulipas, in northeastern Mexico during 2001-2002. Sunlight-shading conditions were created by placing potted piquin plants under or next to flamboyant trees. Direct sunlight and subsequent higher temperatures, particularly during afternoon, reduced piquin growth and yield, probably related to evolution of piquin growing under shade of trees and shrubs in its natural habitat. Growth and yield was higher with none and morning sunlight. This information is important for piquin potential exploitation in intercropping systems with perennial crops.

ADDITIONAL KEY WORDS: chiltepin, flamboyant, light regimes, shading

EFECTO DE LA LUZ SOLAR SOBRE EL DESARROLLO Y RENDIMIENTO DEL CHILE PIQUIN (*Capsicum annuum* L. var. *aviculare*)

RESUMEN

Se estudió el efecto de cuatro tratamientos de incidencia de luz solar (todo el día, sólo por la mañana, sólo por la tarde, y todo el día bajo sombra) sobre el desarrollo y rendimiento del chile piquín (*Capsicum annuum* L. var. *aviculare*) en Río Bravo, Tamaulipas, en el noreste de México durante 2001-2002. Las condiciones de soleado-sombreado fueron creadas al colocar las plantas de chile piquín en macetas bajo o a los lados de árboles de framboyán. La luz solar directa y las temperaturas más elevadas, particularmente durante la tarde, redujo el desarrollo y rendimiento del chile piquín, lo cual se relaciona probablemente con la evolución de esta especie que crece bajo la sombra de arbustos y árboles en su hábitat natural. El desarrollo y el rendimiento fueron mejores en las condiciones de ninguna luz o luz durante la mañana. Esta información es importante para la explotación potencial del chile piquín intercalado con cultivos perennes.

PALABRAS CLAVE ADICIONALES: chiltepin, framboyán, régimenes de luz, sombreado.

INTRODUCTION

An increasing consumer demand for “piquin” pepper, *Capsicum annuum* L., var *aviculare* is evident in Mexico and USA (Pozo *et al*., 1991; Lamberts, 1993; Bosland, 1996). Piquin (chiltepin) is a wild pepper common in woods and shrublands under 1,300 m altitude in Mexico and southern USA. Piquin is being considered as a potential commercial alternative in northern Mexico, especially intercropped with already established perennial crops (e.g. citrus), which provide shading, irrigation, fertilization, and other cultural practices at no extra cost, adding value to the orchard. In the wild, birds are highly attracted to mature piquin fruits (Pozo *et al*., 1991). Seeds are dispersed after bird defecation, resulting in plants growing under partial or total shading close to trees and shrubs. However, the effect of light intensity and regimes on piquin growth and reproduction is not documented. This information is a prerequisite for row orientation and configuration of piquin plants in potential intercropping systems with perennial crops. The objective of this study was to determine the effect of time of exposure to direct sunlight on piquin growth and yield.

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MATERIALS AND METHODS

This study was conducted at the INIFAP Rio Bravo Experiment Station, near Rio Bravo, Tamaulipas, Mexico. Piquin ('San Carlos' accession) seedlings were propagated in 72-cell plastic trays containing sphagnum peat moss (Sunshine mix 3®) during August 2001. Seedlings (5 cm height) were transplanted individually to 32 cm of diameter plastic pots containing 15 kg of potting soil (Vivero los Naranjos, Reynosa, Mexico). Plants were grown from September 2001 to January 2002 under four treatments representing the time of exposure to direct ambient sunlight: (a) all-day; (b) only morning (sunrise to 1200 h); (c) only afternoon (1200 h to sunset); and (d) all-day shaded. None, morning, and afternoon sunlight conditions were created by placing pots under, east, and west of a group of 8-year-old flamboyant trees (*Delonix regia* Rafin), respectively. Visual estimation indicated small gaps in flamboyant dense canopies allowed a maximum of 5 % filtration of direct sunlight. Plants were arranged in a complete randomized design with 10 replications (pots), separated 1 m from each other. Plants were irrigated weekly, and fertilized monthly with 1 liter of soluble fertilizer 20 N-20 P-20 K.

Plant height (cm) was determined monthly. Yield (fresh green fruits with peduncles in g) was evaluated biweekly by hand harvesting. Morning (08:00, 10:00, and 12:00 h) and afternoon (13:00, 15:00, and 17:00 h) temperature (°C) and solar radiation (watts per m^2) were measured daily for each treatment by using a Davis GroWeather® system. Data were analyzed with analysis of variance (ANOVA), and means separated by LSD, with a $P \leq 0.05$ (SAS Institute, 1996).

RESULTS AND DISCUSSION

Solar radiation and temperature differed significantly among the four light conditions (Table 1). Sunlight and temperature were higher during the afternoon than morning. In general, shade provided by flamboyant canopies decreased light intensity and temperature in nearly 80 and 10 %, respectively. Additively, piquin plants at all-day sunlight treatment received the highest temperature and light intensity levels. Conversely, the none light condition had the cumulative lowest temperature and sunlight quantities.

Sunlight regimes affected significantly ($P \leq 0.05$) piquin pepper height and yield (Table 1). Tallest plants were observed in none sunlight condition. Plant anatomy in this condition was similar to that found in the piquin natural shade habitats, mainly in regard to the longer internodes and larger leaves (Almanza, 1993), in relation to the other light conditions. Afternoon and all-day sunlight conditions produced the shortest piquin plants, abnormal in comparison to plants in the wild. Plants under the morning sunlight condition were intermediate in size. Light quality affected significantly stem and leaf morphologies of pepper (Schuerger *et al*., 1997).

Piquin yield was highest in the morning sunlight condition, and lowest in the afternoon and all-day treatments. None sunlight condition produced an intermediate yield. Plants in the afternoon and all-day sunlight coincided to have the lowest growth and yield, suggesting afternoon sunlight was responsible for the poor performance of piquin pepper in this study. When plants grow under a leaf canopy, where the light received is primarily far-red, phytochrome is removed from their leaves and their stems become elongated (Salisburry and Ross, 1992), a situation observed in this study in the none sunlight condition, in contrast to the short stems resulting from the all-day and afternoon light conditions.

This study confirmed piquin as a true shade-type species, growing and yielding best at lower irradiance levels, similar to its native shading habitats. Shade plants can be damaged (photoinhibited) by high light intensity levels (Salisburry and Ross, 1992), which may explain the poor performance of piquin at all-day and afternoon sunlight conditions in this study. In conclusion, direct sunlight, particularly during afternoon, reduced piquin pepper growth and yield, probably an evolutionary trait related to piquin grow-

TABLE 1. Average solar radiation and temperature in four sunlight regime treatments, and their effect on piquin pepper plants growth and yield. September 2001 to January 2002. Rio Bravo, Tamaulipas, Mexico.

Sunlight regime	Solar radiation (watts per m^2)		Temperature (°C)		Plant height[x]	Cumulative yield per plant
	Morning[z]	Afternoon[y]	Morning[z]	Afternoon[y]	(cm)	(g)[w]
All-day	362.7	471.1	25.3	30.1	42.1 c	88.4 c
Morning	344.6	117.8	25.1	26.5	56.7 b	179.5 a
Afternoon	90.7	457.5	23.4	30.0	42.3 c	91.5 c
Shaded	72.5	94.2	23.2	26.4	84.3 a[v]	134.0 b[v]

[z]Daily average from measurements at 8:00, 10:00, and 12:00 h.
[y]Daily average from measurements at 13:00, 15:00, and 17:00 h.
[x]Final (31 January, 2002).
[w]Fresh green fruits with peduncles (7 harvests).
[v]Means within a column followed by the same letter are not significantly different, according to LSD with a $P \leq 0.05$.

ing in its natural habitat under shade of trees and shrubs. Highest yield was obtained with morning light and afternoon shading, a valuable information for potential piquin-perennial crops intercropping systems.

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