Fruit Set Studies in Tomato Under High Temperatures

S. M. F. Satti and N. F. Oebker

Introduction

Production of tomatoes in many arid regions is often limited because of unfavorably high temperatures during flowering and fruit set. Although differences occur among varieties, when temperatures exceed 30°C (86°F), flower formation in most tomatoes is reduced drastically. Flowers that are formed are often undeveloped and fail to reach anthesis and to set fruit.

The physiological mechanism responsible for high temperature inhibition of flowering and fruiting of tomatoes is not clearly understood. It seems probable that reduced levels of growth regulators or unfavorable distribution of carbohydrates may be factors which contribute to prevention of proper flower development.

These studies were undertaken to develop a better understanding of fruit set under Arizona high temperatures. The effects of growth regulators on flowering and fruiting and on carbohydrate content of tomato inflorescences were investigated.

Methods

Tomatoes cv. 'Walter' were grown in the greenhouse and field (Marana) The greenhouse temperatures were 30°C in day and 18°C at night. Field temperatures ranged 32°-42°C in the days and 15°-21°C at night.

The growth regulator treatments were (1) benzylamino-purine (BA) and (2) BA + gibberellins (GA4/7). The solutions were applied to small cotton plugs placed on the inflorescence when visible buds appeared. Total soluble sugars and starch were measured on freeze dried inflorescences.

Results

The number of flowers per inflorescence was increased significantly with BA alone or in combination with GA4/7 in both greenhouse and field experiments (Table 1). Both treatments also increased fruit set at both locations (Tables 1 and 2), but fruit set was less at the high temperatures of the field. Soluble sugars were increased in later stages of development of the tomato inflorescence with the BA treatments.

This indicates that carbohydrate distribution is important to flowering and fruit set. Cytokinins, like BA, seem to play a role in flowering of tomatoes but are not the whole picture. We believe cultural practices can affect the cytokinin level in plants. Studies need to continue on this problem under high temperatures.

Table 1. Effect on BA and BA + GA 4/7 on Number of Tomato Flowers and Percent Fruit Set in the First 3 Inflorescences

	CONTROL	BA	BA+GA4/7
	Number of flowers		
Greenhouse			
1st inflorescence	4.7 a[y]	7.0 b	8.7 b
2nd	4.3 a	7.0 b	8.5 b
3rd	4.4 a	7.2 b	8.3 b
Field (Marana)			
1st inflorescence	2.8 a	5.4 b	7.0 b
2nd	3.2 a	6.0 b	6.0 b
3rd	2.7 a	5.2 b	5.6 b
	Percent of fruit set		
Greenhouse			
1st inflorescence	33 a	71 b	69 b
2nd	57 a	85 b	78 b
3rd	45 a	81 b	71 b
Field (Marana)			
1st inflorescence	17 a	47 c	57 c
2nd	20 a	42 c	42 c
3rd	26 a	56 c	46 b

[y] Row mean followed by the same letter are not significantly different at the 5% level, according to Student-Newman-Keul procedure.

Table 2. Tomato Fruit Number and Weight as Affected by BA and GA 4/7 in the First 3 Florescences

Treatment	Inflorescence	Fruits	Total Fruit Wt Per Inflorescence	Mean Fruit WT
		No.	g	g
Greenhouse				
Control	1st	1.55 a[y]	250 a	161 a
	2nd	2.48 a	311 b	125 b
	3rd	2.00 a	278 ab	139 b
BA	1st	5.02 b	706 c	140 b
	2nd	6.00 b	646 c	107 c
	3rd	5.80 b	634 d	109 c
BA/GA4/7	1st	5.95 b	714 c	119 c
	2nd	6.60 b	656 c	99 c
	3rd	5.90 b	663 c	112 c
Field (Marana)				
Control	1st	0.47 a	68 a	145 a
	2nd	0.63 a	86 b	136 a
	3rd	0.69 a	89 b	129 a
BA	1st	2.56 b	322 c	126 a
	2nd	2.63 b	286 d	108 b
	3rd	3.96 c	266 d	92 b
BA/GA4/7	1st	3.96 c	385 e	97 b
	2nd	2.63 b	288 d	109 b
	3rd	2.60 b	281 d	108 b

[y] Means followed by the same letter within the same column are not significantly different at the 5 percent level, according to Student-Newman-Keul procedure.