Thermodormancy of Several Lettuce Cultivars in Laboratory vs. Field Conditions

J. Coons, J. McGrady, and N. Simons

INTRODUCTION

Thermodormancy of lettuce seeds refers to high temperature inhibition of germination even though seeds are still alive. Lettuce thermodormancy is often a problem for growers in southwestern United States because they plant lettuce during early fall to provide a major portion of the lettuce consumed in the United States during winter. Soil temperatures during these planting times often exceed 35°C, which is above the maximum temperature range of 26 to 33°C for lettuce germination. To help alleviate the high temperature inhibition of germination, growers frequently keep the seed beds wet to lower soil temperatures by evaporative cooling. However even with wet soils, temperatures cannot always be lowered enough. The resulting low germination results in poor stands and nonuniform maturity at harvest. The purpose of our studies was screening several commercial cultivars for high temperature tolerance during this sensitive germination phase and comparing findings from trials in the laboratory vs the field.

PROCEDURES

Laboratory:

Seventeen cultivars of four types (crisphead, leaf, cos, butterhead) of lettuce (Lactuca sativa L.) were germinated in petri dishes in growth chambers in the light at 20, 25, 30, and 35°C. Fifty seeds were placed in each dish, which was lined with filter paper and moistened with 5 ml of distilled water. Dishes were placed inside clear plastic containers. Each treatment was replicated with two to six dishes. Germinated seeds were counted every 2-3 days for 14 days. Seeds were considered germinated when one mm of radicle was visible. Germination percentages were calculated.

Field:

Sixteen cultivars (cos omitted) of lettuce were planted in Yuma, AZ, on August 5 and September 4, 1986 in a randomized complete block with four blocks. Beds were kept wet. Soil temperatures were recorded continuously with a thermistor temperature probe and a Datapod datalogger (model DP211; A181799) at planting depth. Daily maximum and minimum temperatures are plotted in Figure 1. Stands were counted periodically until no further emergence was observed (3 - 4 weeks after planting). Percentage emergence was calculated, with data analyzed by analysis of variance followed by Duncan's multiple range.

RESULTS

Laboratory:

Crisphead and leaf ('Grand Rapids' and PI 251245) were more heat tolerant than cos ('Paris Island Cos') or butterhead cultivars (Figure 2). Within crisphead cultivars, large decreases in germination began between 30 and 35°C although 'Empire' and 'Red Coach' had slightly more tolerance than the rest. Within leaf cultivars, germination also decreased greatly between 30 and 35°C although PI 251245 showed greater heat tolerance than 'Grand Rapids'. With the cos, cultivar germination began to decrease between 25 and 30°C. Within butterhead cultivars, germination in 'Nanda' and 'Mariska' began to decrease between 25 and 30°C although in 'Dabora', 'Severa' and 'Ramona,' the germination began to decrease between 20 and 25°C.

Field:

For the August planting, maximum soil temperatures were around 30 -35°C while minimum temperatures were around 20°C (Figure 1). Percent emergence was similar for crisphead and leaf types with the exception of 'Great Lakes', and much lower for butterhead types (Table 1).

For the September planting, maximum soil temperatures were around 25 -35°C while minimum temperatures were around 15°C (Figure 1). Percent emergence for all cultivars of all types of lettuce were quite similar (Table 1).

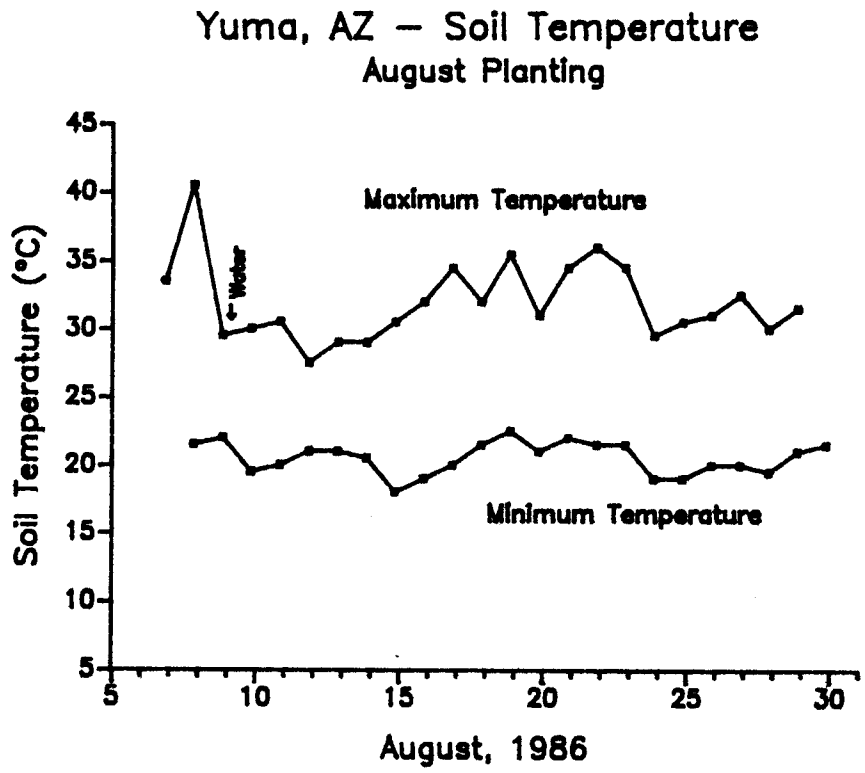
SUMMARY

Crisphead and leaf types had greater heat tolerance than cos and butterhead types, as shown by their ability to germinate at higher temperatures. Relative heat tolerance of the different types was similar in the laboratory and the August planting, but not in the September planting where all types responded essentially the same. Responses observed in September may be due to lower minimum temperatures (i.e., 15°C vs 20°C) which would allow even the most sensitive types to germinate.

Table 1. Percentage emergence of several lettuce cultivars three to four weeks after planting on two dates in Yuma, AZ.

	Date of Planting	
Cultivars	August 5	September 4
Crisphead		
Coolguard	48a[z]	34a
Climax	41ab	46a
Wintersupreme	41ab	46a
Vanguard	40ab	36a
Red Coach	38ab	38a
Empire	37ab	33a
Mesa	32 b	37a
Salinas	28 bc	41a
Great Lakes	15 cd	36a
Leaf		
PI 251245	-	51a
Grand Rapids	38ab	21a
Butterhead		
Nanda	12 d	40a
Ramona	9 d	45a
Mariska	8 d	35a
Dabora	0 d	38a
Severa	0 d	30a

[z]Means followed by same letter within columns are not significantly different based on Duncan's multiple range at 5% level.



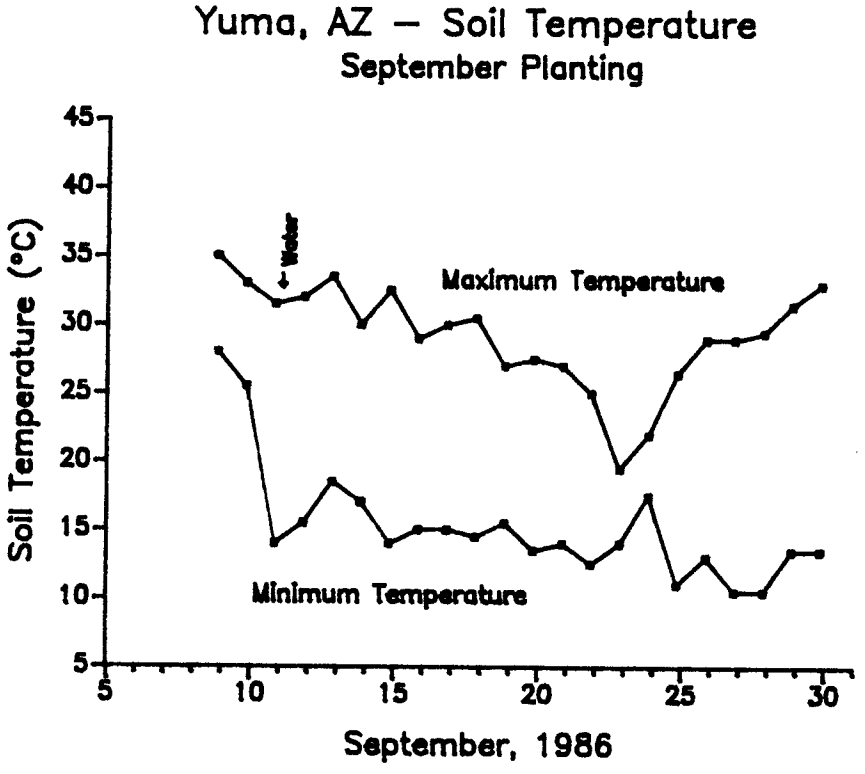


Figure 1. Daily maximum and minimum soil temperatures at lettuce planting depth following August and September plantings in Yuma, AZ.

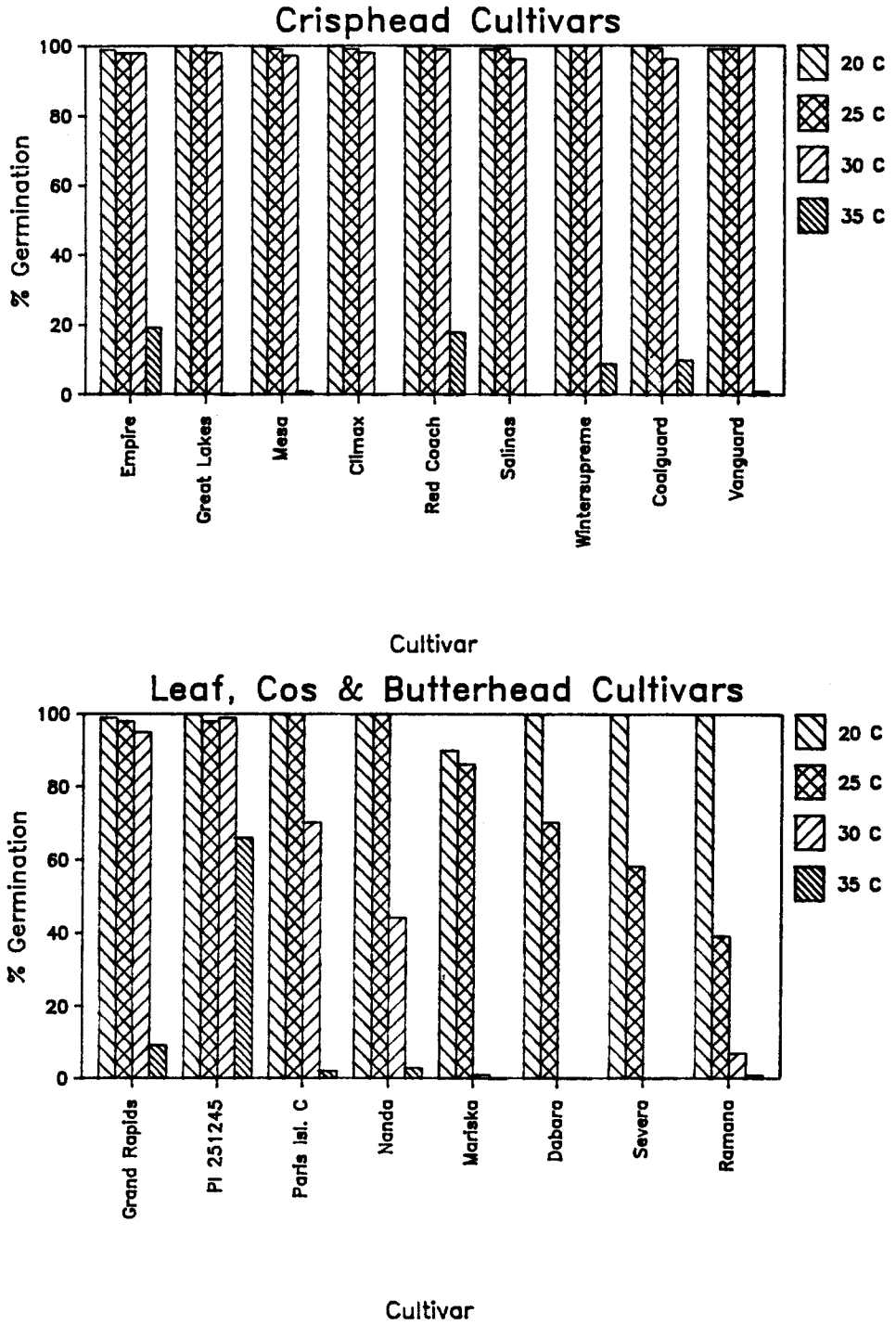


Figure 2. Germination of several cultivars of lettuce at four temperatures in laboratory growth chambers.