

# MOSQUITO BARRIER®

## Tests of Mosquito Barrier® Garlic Juice

12/27/1995

Report Prepared by:

Bill E. Brock, Garlic Research Labs, 624 Ruberta Avenue, Glendale, CA 91201-2335

### ABSTRACT

Diluted garlic juice was sprayed on the resting areas (flowers, grass, shrubs, trees, turf, And vines) to repel Aedes, Anopheles, Culex and other species of mosquitoes in field tests.

Applications were made at different intervals using various spraying equipment at maximum labeled rates. The effects of applications were determined from landing rate counts (LC) of adult mosquitoes and visual sightings were utilized to evaluate the annoyance effects. A diluted solution containing 0.99% of garlic juice repelled mosquitoes for multiple weeks in field tests conducted at assorted geographical locations. In aggregate, the results indicate that garlic juice (with the trade name of **Mosquito Barrier®**) was effective in repelling adult mosquitoes from their resting areas.

---

### INTRODUCTION

Garlic, *Allium Sativum* L., described as a medicinal plant by the Greek physician Dioscorides, has been used for thousands of years for treating a variety of human illnesses. Modern studies confirm that garlic oil has antibacterial, antifungal, amoebicidal, insecticide, and repellent properties (Olkowski et al 1991).

Intercropping with garlic plants for insect control is a long-established practice in tropical and subtropical agricultural regions (Potts 1990). Home gardeners use garlic preparations for insect control although it is known to have a wide range of insecticidal properties and is repellent or toxic to beneficials as well as pest insects (Masseh 1982). Garlic formulations have been reported to kill pest insects from several orders as well as other arthropods (Flitit et al. 1995).

Our attention was drawn to the potential use of garlic to repel mosquitos by reports from the end-users of our agricultural insect repellent product, Mosquito Barrier®. These end-users were primarily farmers and gardeners who frequently reported that not only were the target pests repelled but also mosquitos

### MATERIALS AND METHODS

General Methods:

Varying geographical areas for the field tests were selected as a result of direct requests from product end-users (campgrounds, golf courses, private residences, and a horse-race track) who responded to a print advertisement and indicated serious existing mosquito infestation and subsequently demonstrated an ability to field-test the product.

The end-users selected for the tests were: one campground, five golf courses, five private residences, and one horse-race track.

The test sites were in California, Florida, Maine, Michigan, Minnesota, New Hampshire, New York, North Dakota, Pennsylvania, South Dakota, and Texas. These states offered a wide variety of climatic conditions and environments.

All tests were conducted during the spring and summer of 1995, beginning in May and ending in October. The test sites ranged in size from one-thousand five hundred ( 1500) square feet to one-hundred and ninety (190) acres in order to reflect actual use conditions.

Diluted garlic juice was applied by a variety of equipment including: boom sprayers, garden hose sprayers, hand sprayers, jet pack sprayers, and tractor sprayers, which ever was appropriate for the area covered, on to thoroughly cover mosquito resting places (flowers, grass, shrubs, trees, tuff, and vines) paying close attention to insure that the underside of all foliage received treatment.

Spray volume applications of ten (10) to twenty (20) gallons of diluted product per acre were made either early in the morning or late in the day with little or no wind present, aid with no rain in the forecast for at least forty-eight (48) hours, according to label directions. of 1:100 mixture

The testing schedule included different environmental conditions, such as low to high precipitation, cloudy versus sunny conditions and varying humidity and temperature.

Landing-rate base counts were conducted prior to the scheduled spray applications (treatment) and weekly thereafter at the same location. The landing counts used to evaluate the pre-and-post. treatment mosquito population estimates were taken over a one-minute period beginning immediately after a five-minute waiting period. Visual sightings were also conducted in conjunction with the landing rate counts inside and outside the treated areas to provide a useful index to the annoyance rate.

Close observation was continued throughout the test duration for any indication of adverse effects on plants, animals and inanimate objects,

## **TEST CONTROLS AND PROCEDURES**

### **PURPOSE OF TEST**

To determine the efficacy of garlic juice when diluted and sprayed on foliage for the express purpose of repelling mosquitos from their resting areas.

### **CONTROLS**

The following controls were used in all tests conducted.

- Test Substance: Garlic Juice diluted with Water. Active Ingredient: Allium Sativum Type of Formulation Liquid Concentrate - 99.3 % Garlic juice and Content: Diluted 100 parts Water to 1 part Garlic Juice
- Diluent , Tap Water
- Dosage Rate: .99% by weight of Active ingredient per Gallon of diluted product.
- Mode of Entry, Movement Adherence to fofiage and absorption by plant. Acts as a repellent.
- Lot Sample Date: All product used was supplied from production run dated 04/04/95.

- Manufacturer: Garlic Research Labs  
624 Ruberta Avenue Glendale, CA 91201-233 5

## PROCEDURES

The following procedures were used in all tests conducted.

- Method of Application: Top and underside of foliage, sprayed at a minimum rate of ten (10) gallons of diluted product per acre and a maximum rate of twenty (20) gallons of diluted product per acre.
- Statistical Procedures: Landing rate count and visual sightings count data were analyzed before and after application and the extent of repellency was calculated using Formula III (Mulla et al. 1975.)
- % control or repellency =  $100(T/C)100$ ,  
where  
T= Mean Number of per sample in Treated Area and  
C = Mean Number per Sample in Untreated (Control) Area

## TEST DATA

Test #1

### GENERAL INFORMATION

Personnel Data - Steve Simonson  
Certified Golf Course Superintendent  
Apple Creek Country Club  
P.O. Box 161 I, Bismarck, North Dakota 58502

Testing Period Start: May 25th, 1995 Time of Application: 7:15 am  
End: July 20th, 1995

Geographic Area - State: North Dakota County: Burleigh- Town: Bismarck

Description of 30 acres of golf course containing abundant trees with adjacent wetlands.

Application Site

Climatic Factors: Precipitation: 0 Temperature: 65 deg. F Sunlight/Sky: Cloudy Humidity: 59%  
Wind: 1 mph Variables: Periodic rain- during test period

Selection Rationale - Mosquito infestation, Audubon Sanctuary Golf Course, heavily wooded with an extreme climate range.

Equipment - Boom Sprayer

### TEST DATA

Pest Population: Repellency of mosquito populations reported in one minute landing count per week, for eight weeks. Base count represents landing counts prior to treatment:  
Base (Week #)

Area Count 1 2 3 4 5 6 7 8

Treated 27 1 1 0 1 3 1 1 2

Control 3 1 35 9 19 29 30 26 18 4

Percentage of Repellent Efficacy: 94.7%

## **TEST A 2**

### **GENERAL INFORMATION**

Personnel Data - Ethel Bardsley, Grounds Superintendent Sandy River Golf Course

George Thomas Road, Farmington Falls, Maine 04940

Testing Period - Start: May 28th, 1995

End: July 24th, 1995

Time of Application: 7:30 am

Geographic Area - State: Maine County: Franklin Town: Farmington Falls

.Description of 3 acres of golf course, clubhouse with open deck surrounded with shrub

Application Site trees, turf, and a driving range.

Climatic Factors - Precipitation: 0 Temperature: 59 deg. F Sunlight/Sky: Partly cloudy Humidity: 58% Wind: 2 mph Variables: Heavy rains during test period Selection Rationale - Mosquito infestation, river runs through site, has northern climate.

Equipment - Hand Sprayers

### **TEST DATA**

Pest Population: Repellency of mosquito populations reported in one minute. Landing counts per week, for eight weeks. Base count represents landing counts prior to treatment:

Base (Week )

Area Count 1 2 3 4 5 6 7 8

Treated 27 1 1 1 0 1 1 2 2

Control 24 26 19 5 17 15 12 20 17

Percentage of Repellent Efficacy: 93.1%

## **TEST # 3**

### **GENERAL INFORMATION**

Personnel Data - Larry Murphy  
Rockingham Park Race Track  
1 Rockingham Blvd., Salem, New Hampshire 03079

Testing Period - Start: June 3rd, 1995 End: July 31st, 1995 Time of Application: 5:10 am

Geographic Area - State: New Hampshire County: Rockingham Town: Salem

Description of 190 acre horse-race track with a large amount of ornamentals, trees and

Application Site open grass areas. Structures include grandstand, stables, and storage.

Climatic Factors - Precipitation: 0 Temperature: 67 deg. F Sunlight/Sky: partly cloudy -Humidity: 65% Wind: 3 mph Variables: None

Selection Rationale - Mosquito infestation, numerous bodies of water, race-horses on-site.

Equipment - Tractor Sprayer Jet packs

#### TEST DATA

Pest Population: Repellency of mosquito populations reported in one minute landing counts per week for eight weeks. Base count represents landing counts prior to treatment:

Base (Week)

Area Count 1 2 3 4 5 6 7 8

Treated 19 1 1 1 1 1 1 1

Control 2 1 24 29 16 27 25 14 18 23

Percentage of Repellent Efficacy: 95.5%

#### TEST # 4

#### GENERAL INFORMATION

Personnel Data - Rick Kerins, Superintendent Tam O'Shanter Golf Course Interstate 80, Hemiitage, Pennsylvania 16159

Testing Period - Start: June 2nd, 1995 End: August 2nd, 1995 Time of Application: 6:10 am

Geographic Area - State: Pennsylvania County: Mercer Town: Hen-nitage

Description of 2/3 acres of golf course driving range with clubhouse.

Application Site

Climatic Factors - Precipitation: 0 Temperature: 68 deg. F Sunlight/Sky: Clear Humidity: 59% Wind: 2 mph Variables: Drought conditions during test

Selection rationale - Mosquito infestation, on-going drought, located in foothills.

Equipment - Hand Sprayers

#### TEST DATA

Pest Population: Repellency of mosquito populations reported in one minute landing co per week for eight weeks. Base count represents landing counts prior t treatment:

Base (Week

Area Count 1 2 3 4 5 6 7 8

Treated 22 0 1 2 0 1 0 2 1

Control 23 29 16 30 9 20 26 14 19

Percentage of Repellent Efficacy-: 95.7%

#### TEST 5

##### GENERAL INFORMATION

Personnel Data - Jim Farhat Certified Golf Course Superintendent Pine Lake CountryClub Orchard Lake, Michigan, 48324

Testing Period - Start: June 14th, 1995 Time of Application: 3:15 pm End: August 16th, 1995

Geographic Area - State: Michigan County: Oakland Town: Orchard Lake

Description of 1 acre of golf course with clubhouse located in the center, surrounded b

Application Site ornamentals, tall shrubs, and trees. Guests want organics

Climatic Factors - Precipitation: 0 Temperature: 83 deg. F Sunlight/Sky: Partly cloudy Humidity: 72% Wind: 7 mph

Variables: None

Selection Rationale - Mosquito infestation, numerous bodies of water.

Equipment - Boom Sprayer

#### TEST DATA

Pest Population: Repellency of Mosquito populations reported in one minute landing count per week for eight weeks. Base count represents landing counts prior to treatment:

Base (Week

Area Count 1 2 3 4 5 6 7 8

Treated 22 0 1 2 0 1 0 2 1

Control 23 29 16 30 9 20 26 14 19

Percentage of Repellent Efficacy: 95.7%

## **TEST # 6**

### GENERAL INFORMATION

Personnel Data - Tom Haugen, Course Superintendent Stonebrook Golf Club 2693 County Road 79, Shakopee, Minnesota 55379

Testing Period - Start: July 6th, 1995 End: August 31 st, 1995 Time of Application: 7:30 am

Geographic Area - State: Minnesota County: Scott Town: Shakopee

Description of 55 acres of golf course, 2 small ponds, heavily wooded. Located on

Application Site edge of Lake O'Dowd. Clubhouse has open air patio.

Climatic Factors - Precipitation: Temperature: 64 deg. F Sunlight/Sky: Partly cloudy Humidity: 68%  
Wind: 2 mph

Variables: None

Selection Rationale - Mosquito infestation, extreme weather features, borders a lake, and contains ponds. Equipment - Tractor Boom Sprayers Jet Pack

### TEST DATA

Pest Population: Repellency of mosquito populations reported in one minute landing count per week, for eight weeks. Base count represents landing counts prior treatment:

Base (Week

Area Count 1 2 3 4 5 6 7 8

Treated 29 0 2 2 1 1 1 2 2

Control 3 1 19 26 24 21 15 20 11 21

Percentage of Repellent Efficacy: 93.1%

**TEST # 7**

GENERAL INFORMATION

Personnel Data - Deborah Huber

2532 Wild Oak Drive, Hollywood, California 90068

Testing Period - Start: July 9th, 1995 Time of Application: 7:00 pm End: September 1st, 1995

Geographic Area - State: California County: Los Angeles Town: Los Angeles

Description of 1500 square foot residential lawn with ornamentals and evergreens

Application Site concerned about environmental issues

Climatic Factors - Precipitation: 0 Temperature: 76 deg. F Sunlight/Sky: Clear Humidity: 68%  
Wind: 9 mph

Variables: None

Selection Rationale - Mosquito infestation, mild climate , part of major metropolitan coastal environment surrounded by low mountains and hills.

Equipment - Hand Sprayer

TEST DATA

Pest Population: Repellency of mosquito populations reported in 1 minute landing counts per week, for eight weeks. Base count represents landing counts prior to treatment:

Base (Week

Area Count 1 2 3 4 5 6 7 8

Treated 1 2 0 0 1 2 0 1 0 0

Control 10 1 1 8 12 10 4 7 9 6

Percentage of Repellent Efficacy: 94.0%

**TEST # 8**

GENERAL INFORMATION

Personnel Data - Jerry Taylor, Owner/Manager  
Badlands/White River KOA Family Campground  
Kampgrounds of America

HCR 54, Box 1, Interior, South Dakota 57750

Testing Period - Start: July 1<sup>st</sup>, 1995 Time of Application: 6:45 am End: September 5<sup>th</sup>, 1995

Geographic Area - State: South Dakota County: Jackson Town: Interior

Description of 31 acre campground, 700 trees mostly cottonwoods, wide variety of

Application Site shrubs, grassy areas and structural camping amenities.

Climatic Factors - Precipitation: 0 Temperature: 63 deg. F Sunlight/Sky: Clear Humidity: 58% Wind:  
3.mph Variables: None

Selection Rationale - Mosquito -infestation, borders a river, heavily wooded with large amounts of  
vegetation and grass lands. Children and pets as guests

Equipment-- Solo "Mist Blower and a Jet Pack Sprayer"

#### TEST DATA

Pest Population: Repellency of mosquito populations reported in one minute landing counts per week,  
for eight weeks. Base count represents landing counts prior to treatment:

Base (Week H)

Area Count 1 2 3 4 5 6 7

Treated 28 0 1 1 2 1 0 1 1

Control 21 19 22 31 18 20 23 17 19

Percentage of Repellent Efficacy: 95.9%

#### **TEST 9**

##### GENERAL INFORMATION

Personnel Data - Pat Wright, 403 Glengrove Drive

Youngstown, New York 14174

Testing Period -Start: July 17<sup>th</sup> , 1995 Time of Application: 5: 10 pm

End: September 18<sup>th</sup>, 1995

Geographic Area State: New York County: Niagara Town Youngstown

Description of 2/3 acre private residence with numerous shrubs,

Application Site extensive flower beds and surrounded by woods

Climatic Factors - Precipitation: 0 Temperature: 78 deg. F Sunlight/Sky: Partly cloudy Humidity: 73% Wind: 6 mph

Variables: None

Selection Rationale - Mosquito infestation, flat land adjacent to Niagara River and Lake with extensive swamp areas.

Equipment - Garden Hose Sprayer

#### TEST DATA

Pest Population: Repellency of mosquito populations reported in one minute landing per week, for eight weeks. Base count represents landing counts per treatment:

Base (Week

Area Count 1 2 3 4 5 6 7 8

Treated 28 1 1 1 2 1 2 1 1

Control 3 1 27 24 13 22 19 21 28 17

Percentage of Repellent Efficacy: 94.2%

#### **TEST # 10**

##### GENERAL INFORMATION

Personnel Data - Penni J. LaBute, 1960 South Hammond Lake Drive

Bloomfield Hills, Michigan 48302

Testing Period - Start: July 27th, 1995 Time of Application: 8:00 pm End: September 28th, 1995

Geographic Area - State: Michigan County: Oakland Town: Bloomfield Hills

Description of 1 acre private lakefront property; 1/3 covered with ground covers, shrubs, Application Site trees, the remainder consisting of a large sand beach. Landscaped yard surrounds the residence.

Climatic Factors - Precipitation: 0 Temperature: 72 deg. F Sunlight/Sky: Cloudy Humidity: 70% Wind: 5 mph

Variables: None

Selection Rationale - Mosquito infestation, large lakefront property, beach area, extensive ground cover with wooded areas

Equipment - Garden Hose Sprayer

#### TEST DATA

Pest Population: Repellency of mosquito populations reported in one minute landing co per week, for eight weeks. Base count represents landing counts prior treatment:

Base (Week

Area Count 1 2 3 4 5 6 7 8

Treated 28 1 2 1 1 0 1 2 1

Control 36 22 34 19 27 12 22 17 19

Percentage of Repellent Efficacy: 94.8%

#### TEST # 11

#### GENERAL INFORMATION

Personnel Data - Mildred Jeffries 12105 Seagoville Road, Balch Springs, Texas 75180

Testing Period - Start: July 24th, 1995 Time of Application: 5:45 am End: September 29th, 1995

Geographic Area - State: Texas County: Dallas Town: Balch Springs

Description of 20 acres with ornamentals and lawn area adjacent to a residence

Application Site and open acreage containing trees, tall grasses, weeds, shrubs

Climatic Factors - Precipitation: 0 Temperature: 62 deg. F Sunlight/Sky: Clear Humidity: 67% Wind: 4 mph Variables: None

Selection Rationale - Mosquito infestation, hot summers, adjacent to metropolitan area in terrain.

Concerns about chemical reactions

Equipment - Tractor Sprayer

#### TEST DATA

Pest Population: Repellency of mosquito populations reported in one minute landing count per week, for eight weeks. Base count represents landing counts prior treatment:

Base (Week

Area Count 1 2 3 4 5 6 7 8

Treated 28 0 1 1 2 0 2 0 1

Control 24 12 19 18 17 14 9 16 8

Percentage of Repellent Efficacy: 93.8%

## Discussion of Test Results

Significant numbers of adult mosquitoes were immediately repelled from the test areas and the repellence continued to some degree for up to **TWO WEEKS** with **ONE** application of **Mosquito Barrier®**. This is the **concentrated form**, in gallon or 50 gallon drums. This reduction in mosquitoes benefited adults and children as well as animals by changing intolerable conditions into environments in which work, play and general recreation could take place, comfortably. It shows that an 'ORGANIC' ("Natural" or "EPA Exempt") product can be used effectively to control, repel and suppress mosquitoes.

The suggested **Effective Dosage Range is FIVE (5) to TEN (10) Gallons of diluted Mosquito Barrier per acre**, starting with the least taxing conditions and ending with the most taxing conditions. The garlic odor lasted about 30-60 minutes. This effective dosage rate reflects the formula changes we have made to the product since 1995.

There was no indication of any adverse effect from the use of the product on any test site. Several of the golf courses, private residences and the horse track sprayed hard surfaces such as lower club houses, grandstands, parking lots, patios, patron dining areas, stables and storage structures in order to ensure that mosquitoes were deprived of resting places. This means that **Mosquito Barrier®** came into contact with wood, paint, metal, plastic and fabric. The suggested performance Standard would be a repellency rate of **93-95%** of adult mosquitoes for a period of 1 to 2 Weeks after thorough application, according to label instructions.

It is important to note that these tests were conducted in open areas subject to mosquito fly-through and mosquitoes carried by the wind from untreated areas. No allowances were made for this uncontrollable situation.

**Test results determined by averaging the percent of repellency from each test site resulted in a Repellency Efficacy Rate of 93-95% for up to TWO WEEKS.**

### **Acknowledgement:**

I wish to thank the many private individuals and representatives of companies and clubs that participated in this test, FOR NO CONSIDERATION, other than the spraying of their properties and the benefit of being able to enjoy their sites free of mosquito buzzing.

**Sincerely**

**Bill Brock**  
**Executive Partner**  
**Garlic Research Labs**  
**12/27/1995**  
**Renewed and Updated 2/1/2001**