# NATURALIS-L: A BIOLOGICAL PRODUCT (*BEAUVARIA BASSIANA* JW-1) FOR THE CONTROL OF COTTON PESTS

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## Abstract

The patented *Beauveria bassiana* JW-1 strain of fungus is active as a mechanical (non-chemical) mode of action against major cotton pests including whiteflies (*Bemisia tabaci*), mites (*Tetranychus urticae*) and bollworm (*Helicoverpa* ssp.). Studies indicate that beneficials such as *Encarsia* spp., *Eretmocerus* sp., *Chrysoperla* spp., and others are not impacted by the *B. bassiana* JW-1 strain.

The target pests must come into contact with the fungal spores after direct application, movement on treated surfaces, or bodily contact with other target pests already exposed (horizontal transfer).

Naturalis®-L (commercial name) can be tank mixed with most pesticides and fertilizers but not with most fungicides. Some identified fungicides are compatible; however, a time interval of 48 hours before or after application of fungicides is suggested. Extensive evaluation has yielded no observed phytotoxicity. Toxicological studies indicate that the Naturalis-L does not have an adverse impact on humans, livestock, birds, fish, beneficial insects, crops, waterways, or groundwater resources.

## Introduction

The continued development of insecticide resistance to current commercial products and the inherent toxicity of existing synthetic pesticides to nontarget organisms and their persistence in the environment are strong dictates for identification of alternative control measures.

The development of a biological alternative with similar control activity has been sought for many years with few successes, e.g., *Phytoseiulus persimilis* and *Bacillus thuringiensis*.

This presentation is to report on a biological alternative that is used successfully for insect control and also addresses important concerns today throughout the world, e.g., insect resistance, persistance, residues, nontarget and safety, etc.

Naturalis is a commercial formulation that contains a patented insect-specific fungus, *Beauveria bassiana* JW-1. This new propriety biological product has demonstrated excellent efficacy throughout the world against major pests of cotton, vegetables, ornamentals, and turf.

The activity of *Beauveria bassiana* JW-1 is manifested as a contact material in which the conidia of the fungus attaches to the insect cuticle which uses the insect for nutrition and growth which results in the death of the insect. The biological activity is expressed over a period of time and expression of death is variable depending upon the species attacked.

## Materials and Methods

Naturalis-L is a flowable formulation that can be applied with conventional application equipment, including backpack sprayers, aerial, conventional ground, air-assisted, electrostatic equipment, etc.

Insects were sampled prior to applications and at intervals thereafter. In field crops, damage, insect counts, plant phenology, and ultimately, yield was determined. The studies were arranged as a randomized block design with a minimum of three replications and statistically analyzed.

### Whiteflies

In Mexico, Naturalis-L was assessed against whiteflies (*B. tabaci*) in replicated trials on cotton. The infested cotton was treated with Naturalis-L by itself at 750 ml/ha, Naturalis-L at 750 ml/ha and Thiodan 1.5 L/ha, Thiodan at 1.5 L/ha and untreated controls. The cotton was evaluated for percent control of whiteflies at 0, 6 and 12 post treatment.

In Pakistan, Naturalis-L was assessed against whiteflies (*B. tabaci*) on cotton. Cotton was treated with Naturalis-L at a rate of 750 ml/L and an untreated control.

### Bollworm

In Australia, replicated trials were carried out against bollworms (*Helicoverpa zea*) in Australian cotton with Naturalis-L and Delfin OF. The treatments were Naturalis-L only at 750ml/ha, Naturalis-L at 750 ml/ha and Delfin OF at 2 L/ha, Delfin OF at 2L/ha and Endosulfan ULV at 2.1 L/ha and thiodicarb at 0.5 L/ha. Ten counts were made over a 2 month period in the field.

In Pakistan, bollworm (*Helicoverpa* ssp.) infested cotton was treated with Naturalis-L at a rate of 750 ml/hectare. The treated cotton was compared to an untreated control.

### Spider Mites

Naturalis-L was tested in the central San Joaquin Valley in Goshen, CA against two spotted spider mites (*T. urticae*). The cotton growth stage was between eight and nine node. The cotton was treated with Naturalis-L at a rate of 15 oz/acre and evaluated against an untreated control.

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**Nontarget insects**
Numerous studies in different environments have determined that Naturalis does not affect key predators and parasites of pest species. Some examples are: *Chrysoperla* sp., *Geocoris* sp., *Encarsia* sp., *Scymus* sp., *Micromus* sp., *Nabis* sp., and various arachnids.

## Results

**Whiteflies**
Naturalis-L in Mexico illustrated control of whiteflies compared to Thiodan alone and Naturalis-L plus Thiodan (Table 1).

In Pakistan, Naturalis-L demonstrated efficacy against whiteflies in cotton (Figure 1).

**Bollworm**
Efficacy is demonstrated against *Helicoverpa* ssp. in Australian cotton is shown in Table 2.

*Helicoverpa* ssp. in Pakistan showed a high level of control compared to the untreated control (Figure 2).

**Spider Mites**
Decrease of spider mite (*Tetranychus urticae*) populations on cotton is demonstrated in Figure 3.

**Nontarget insects**
Lack of effects on nontarget beneficials were recorded in fields with multiple applications of Naturalis and no effects were observed (Table 3).

**Cotton yields**
Significant increases in cotton yields were observed in fields in Pakistan (Figure 4).

## Conclusions

Naturalis-L has shown excellent efficacy against whiteflies, bollworm and spider mites. In the data presented above, the insect populations decreased. The control demonstrated by Naturalis-L was also comparable to the control using commercial insecticides.

Its active ingredient, *Beauveria bassiana* JW-1, has excellent environmental and toxicological safety properties.

Results in numerous studies have significantly demonstrated that Naturalis does not interfere with important predators and parasites.

Naturalis-L can be applied with conventional application equipment.

Table 1. Control of *Bemisia tabaci* in Mexico on cotton.

| Treatment | Rate L/HA | % Control DAT | |
|---|---|---|---|
| | | 6 | 12 |
| Control | ---- | 0 | 0 |
| Naturalis | 0.75 | 91 | 88 |
| Naturalis + Thiodan | 0.75 + 1.5 | 89 | 70 |
| Thiodan | 1.5 | 78 | 58 |

Table 2. Effect of Naturalis-L on Helicoverpa zea in Australian cotton

| Total infestation (mean number of eggs & larvae) per meter of row. Program | Date | | | |
|---|---|---|---|---|
| | 11/18 | 11/22 | 11/27 | 12/03 |
| Naturalis-L | 4.0 | 1.5 | 0.5 | 6.5 |
| Naturalis-L + Delfin Of | 1.5 | 1.5 | 1.5 | 6.5 |
| Delfin Of | 5.0 | 1.5 | 1.5 | 7.5 |
| Insecticide | 3.6 | 2.5 | 3.5 | 11.8 |

Table 2 Continued. Effect of Naturalis-L on Helicoverpa zea in Australian cotton

| Total infestation (mean number of eggs & larvae) per meter of row. Program | Date | | | | |
|---|---|---|---|---|---|
| | 12/09 | 12/15 | 12/23 | 12/31 | 1/07 |
| Naturalis-L | 0.5 | 0.5 | 16.5 | 1.00 | 9.5 |
| Naturalis-L + Delfin Of | 2.5 | 1.5 | 17.0 | 0.0 | 8.0 |
| Delfin Of | 0.0 | 0.5 | 3.5 | 3.0 | 7.5 |
| Insecticide | 0.0 | 2.6 | 8.3 | 1.0 | 0.7 |

Table 3. Effect of Naturalis-L on some beneficial insects on commercial cotton in Australia

| Treatments | No. per sample date per meter | | |
|---|---|---|---|
| | C. repanda | D. notescens | Chrysopa spp. |
| Naturalis-L | 0.225a | 0.212a | 0.100a |
| Naturalis+Bt | 0.246a | 0.208a | 0.092ab |
| Control (Unsprayed) | 0.213a | 0.388a | 0.142a |
| Conventional (Sprayed) | 0.071b | 0.046b | 0.045b |

Table 3 Continued. Effect of Naturalis-L on some beneficial insects on commercial cotton in Australia.

| Treatments | No. per sample date per meter | |
|---|---|---|
| | N. capsiformis | D. bellulus |
| Naturalis-L | 0.158a | 0.092a |
| Naturalis+Bt | 0.082ab | 0.091a |
| Control (Unsprayed) | 0.213a | 0.142a |
| Conventional (Sprayed) | 0.042b | 0.030b |

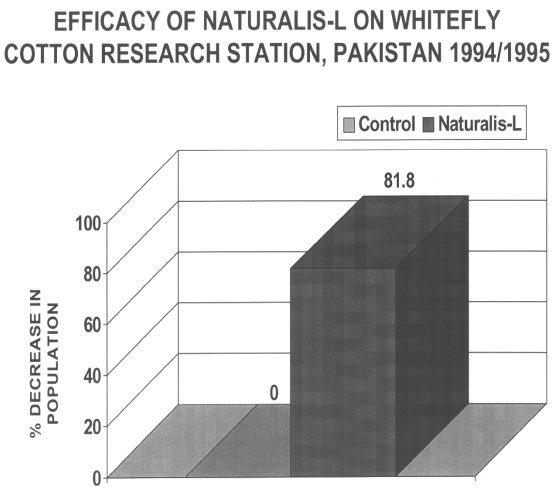


Figure 1.

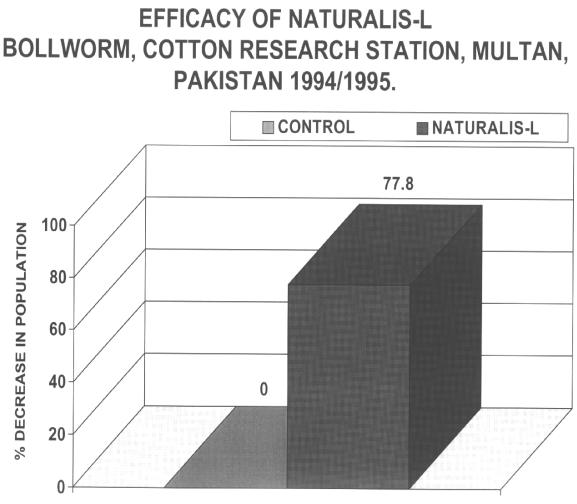


Figure 2.

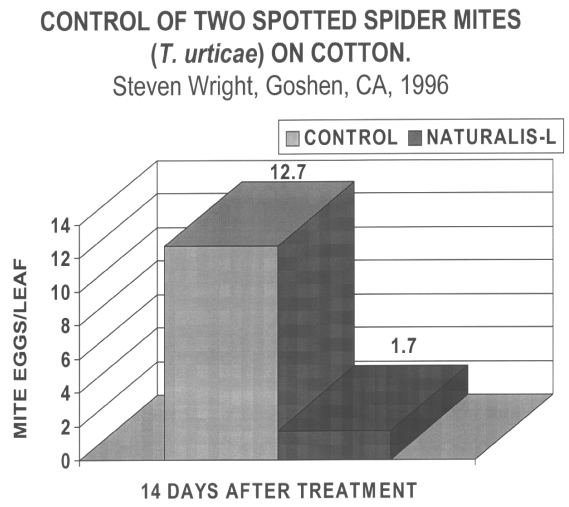


Figure 3.

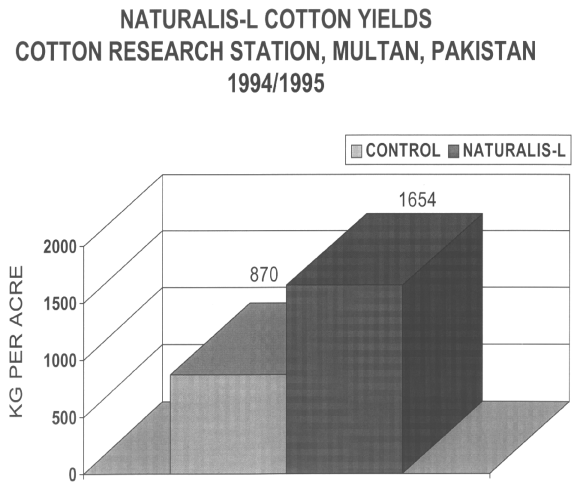


Figure 4.