

**INTERNATIONAL EXPERIENCE WITH
FINISH (CYCLANILIDE + ETHEPHON)
BOLL OPENER & DEFOLIANT.**

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Abstract

FINISH™ (60 g cyclanilide + 480 g ethephon ai's per liter) has been tested for the promotion of earlier, concentrated boll opening and defoliation over the past four years in all major cotton growing countries. More than a hundred trials were laid out outside of the United States in a broad variety of conditions. The results obtained show that FINISH™, at equivalent ai. rates ensured as good or often better boll opening than PREP® and as good or often better defoliation than the best defoliant (Merphos, Thidiazuron) whether these were used alone or in tank mixture with Prep®. FINISH™ also provided a good inhibition of juvenile regrowth and its boll opening/defoliant efficacy was only slightly decreased at lower temperatures.

Typical examples from the mentioned trial work are presented in this paper.

Introduction

In cotton (*Gossypium spp.*) similarly to other plant species, the dehiscence processes such as square, boll, leaf shedding (abscission) and boll opening (the splitting of carpels) is mediated by the balance between the plant hormones ethylene and auxin (IAA).

Dehiscence is stimulated by a relatively high ethylene and low auxin concentration in the involved organs or tissues. Ethylene inhibits to some extent auxin transport from its site of synthesis in the meristematic tissues and stimulates its break down by boosting the activity of IAA-oxidase and IAA-decarboxylase enzymes. More importantly, it also stimulates the activity of cellulase and pectinase enzymes (probably by increasing their transfer through the plasma membrane to the cell walls) which catalyze the hydrolysis of insoluble pectates and cellulose compounds in the abscission zones.

Dehiscence processes can be induced by exogenous ethylene application either in form of gas (difficult in the field) or as ethephon which is quickly absorbed by the plant tissues and broken down to release ethylene. This last will promote the dehiscence process on its own right and will also stimulate the "in vivo" ethylene biosynthesis.

When roughly 50-60% of total boll load is open the opening of remaining bolls is protracted because the ethylene concentration in the plants decreases. Ethephon (PREP®) application's maintain ethylene concentration in the plant at appropriate levels to promote the opening of all physiologically mature bolls.

The leaf abscission (defoliation) response to ethephon, while not negligible, is generally moderate as compared to boll opening. This is due to the fact that in actively photosynthesizing leaves relatively large amounts of so called "juvenile" plant hormones (auxin) are synthesized and, these are opposing the action of ethylene. By inhibiting the synthesis and transport of auxin, cyclanilide boosts the effect of ethephon in terms of defoliation.

Through combination of these two active compounds into a single formulation the FINISH™ product was developed which stimulates both boll opening and defoliation.

Materials and Methods

In this paper, results only of critical trials are reported.

These were laid out in 3-6 replicates in the locally important commercial varieties. Plot size was generally 4 rows by 10-15 m. Only the two inner rows in each plot were used for efficacy assessments.

Defoliation and boll opening counts were made either along the entire length of rows or on 20 labeled plants in each plot.

FINISH™ was applied at various rates from 1.5 l/ha up to 4.5 l/ha usually in 0.5 l/ha increments.

Other treatments were PREP® and locally used standard defoliant products alone and/or in tank mixture.

The spray volume was most often 150-300 l/ha.

The results were analyzed for statistical significance as appropriate.

Results and Discussion

The available space and time would not allow the reporting of all trials results. Typical examples from each continent other than North America are shown here.

Brazil

Table 1. Boll opening and defoliation of cotton with FINISH™ and PREP® -Brazil 1994

Treatments	Rates g ai/ha	% Boll opening	& % Defoliation-7DAT
UTC	-----	33.3	36.2
FINISH	720+90	57.3	98.1
FINISH	960+120	62.1	98.0
FINISH	120+150	69.4	97.0
PREP	960	50.0	74.9
PREP	1200	57.0	87.8

Europe

In two European countries, Greece and Spain a total of roughly 600 K hectares of well managed cotton is grown. Varieties in which the FINISH trials were conducted included Zeta 2, Crema 111, Coker 310, Korina, Nata and Corona.

Table 2. Cotton boll opening & defoliation with FINISH -7DAT, -Greece 1994.

Treatments	Rates g ai/ha	% Boll opening	& % Defoliation
FINISH	960+120	81.7 ab	70.0 ab
FINISH	1200+150	80.0 ab	76.7 ab
FINISH	1440+180	86.7 a	83.3 a
Ethephon	1440	80.0 ab	53.3 b
Merphos	1790	73.3 bc	76.7 ab
Ethephon+	1200+	66.7 c	85.0 a
Merphos	1430		
Ethephon+	1200+	78.3 ab	60.0 ab
Thidiazuron	125		
UTC	-----	70.00 c	10.0 c

Table 3. Cotton boll opening & defoliation with FINISH 7 DAT, -Spain 1995

Treatments	Rates	% Boll opening	&% defoliation
UTC	-----	56.25	11.25
FINISH	2.5 l/ha	74.00	81.25
FINISH	3.0 l/ha	82.25	93.75
Merphos	2145 g/ha	60.00	96.25
Thidiazuron	175 g/ha	59.75	73.75

Australia

Because it is well established that ethephon promotes boll opening on its own right, in Australia the defoliation efficacy of FINISH was primarily investigated. Probably because of the arid climatic conditions, harvest aid products are less effective in Australia therefore relatively higher rates are used than elsewhere.

Table 4. Cotton var. CS 189+ defoliation with Finish, Australia -1995.

Treatments	Rates	% Defol. 7 DAT	& 10 DAT
UTC	---	20.3 ef	25.3 c
FINISH	3.0 l/ha	78.0 a	91.9 ab
FINISH	3.75 l/ha	81.0 a	94.6 a
FINISH	4.5 l/ha	87.0 a	95.2 a
PREP-720	2.0 l/ha	58.0 bc	82.8 ab
PREP-720	2.5 l/ha	61.7 b	84.7 ab
Thidiazuron	0.125 kg/ha	37.8 de	77.2 b
PREP-720+	0.5 l+	42.3 cd	80.4 b
Thidiazuron	0.125 kg/ha		

The effect of FINISH™ upon juvenile regrowth has also been investigated in several countries and the following

example from Brazil shows that it is practically as effective as thidiazuron used in tank mixture with Prep®:

Table 5. Cotton regrowth 18 DAT's with various harvest aid products, Brazil-1991.

Treatments	Rates l, kg/ha	% regrowth: Top	Bottom
UTC	-----	8.33	3.67
PREP	1.39 l/ha	8.67	4.33
FINISH	2.08 l/ha	0.67	3.00
PREP+	1.39 l+		
Merphos	0.75 kg/ha	2.67	2.33
PREP+	1.39 l+		
Thidiazuron	0.10 kg/ha	0.00	3.33

Conclusion and Recommendations

These examples clearly show that the results obtained with FINISH™ in various cotton growing areas of the world are very much consistent with those generated in the USA during the same time period. Hence, in countries where the registration approval process is somewhat quicker such as Argentina, it has been launched commercially with great success.

In the course of our technical development work it has been noted in a number of instances that the performance of FINISH™ was less dependent on optimum temperature conditions than that of some other harvest aid products. This finding has been subsequently confirmed through "controlled temperature" studies.

Nevertheless both whole cotton metabolism and the response to FINISH™ is temperature dependent, to some extent. Therefore, our current (international) rate recommendations are based upon the temperature at the time of treatment and expectations during the few days immediately after treatment.

Table 6. Finish rate recommendations.

Temperature °C	Finish rate l/ha
Above 35	1.5-2.0
35-31	2.0-2.5
30-26	2.5-3.0
25-21	3.0-3.5
20-17	3.5-4.0
Below 17 : Wait for warmer weather!!	

The higher indicated rates are aimed at rank crops and generally difficult harvest conditions. In most situations the lower rate is appropriate.

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