

Improving white mold management in dry beans:

Comparative fungicide efficacy – general methods

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Market class = pinto in most studies; kidney in some studies

Row spacing = 14 inches in most studies; 28 inches in some studies

Seeding rate = 90,000 viable seeds/ac in most studies; sometimes 80,000 viable seeds/ac

Fungicide spray volume = 15 gal/ac.

Fungicides applied with a hand-held boom pressurized by CO₂.

Fungicide spray droplet size: fine or medium in studies conducted from 2010-2021; fine, medium or coarse, calibrated relative to canopy density and lodging, from 2022-2024.

Number of fungicide applications: two

Application timing, first fungicide application: early bloom and initial pin pod-pod

Interval between fungicide applications: 7 to 14 days later, depending on study

Number of experimental replicates = 5 or 6 replicates (most studies)

White mold assessment: Assessed at or near dry bean maturity by evaluating every plant individually in for the percent of the plant impacted by white mold.

Harvest: To ensure that variability in dry bean standability did not bias yields, plants were clipped at base concurrent with disease assessments, wind-rowed to dry, and manually lifted into the combine.

Supplemental irrigation: Supplemental overhead irrigation was applied as needed to establish the white mold disease pressure needed to evaluate fungicide performance.

1. Fungicides and fungicide application rates that can be applied twice in-season

Testing was conducted with two sequential applications of the same fungicide with the goal of rigorously assessing comparative efficacy.

These comparative efficacy results are provided to help facilitate informed decisions for selecting products for application once or twice in-season, either alone or in rotation with another fungicide.

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ProPulse: active ingredients, prothioconazole (FRAC 3) + fluopyram (FRAC 7)

ProPulse 8.6 fl oz versus ProPulse 10.3 fl oz

Two sequential applications of the same fungicide (early bloom/pin-pod + 11, 12, or 13 days apart)

location	Carrington	Langdon	Langdon	Carrington	Carrington	Carrington	Carrington	Carrington	COMBINED ANALYSIS 8 studies
year	2012	2014	2012	2013	2014	2014	2010	2014	
days between applications	13	12	13	11	12	12	11	12	
nozzles, pressure, first fungicide application	XR8001 35 psi	XR8001 40 psi	AI11002 40 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	XR80015 35 psi	XR8001 35 psi	
nozzles, pressure, 2 nd fungicide application	XR8001 35 psi	XR8001 40 psi	AI11002 40 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	XR80015 35 psi	XR8001 35 psi	
droplet size, applic. #1	fine	fine	extra coarse	fine	fine	fine	fine	fine	
droplet size, applic. #2	fine	fine	extra coarse	fine	fine	fine	fine	fine	
market class	pinto	pinto	pinto	pinto	pinto	pinto	pinto	pinto	
variety	'Maverick'	'Lariat'	'Maverick'	'Lariat'	'Lariat'	'Lariat'	'Lariat'	'ND-307'	
row spacing	30 inches	30 inches	30 inches	14 inches	14 inches	14 inches	15 inches	14 inches	
WHITE MOLD SEVERITY (% of canopy)									White mold (%)
Non-treated control	24 b	33 a	36 a	55 a	72 b	83 b	73 b	78 a	57 b
ProPulse 8.6 fl oz/ac	2 a	23 a	20 a	47 a	57 ab	65 ab	57 a	66 a	42 a
ProPulse 10.3 fl oz/ac	6 ab	25 a	17 a	44 a	50 a	62 a	53 a	69 a	41 a
CV:	78.4	20.5	2.24	18.0	9.0	13.9		16.8	6.9
YIELD (lbs/ac)									Yield (lbs/ac)
Non-treated control	2906 a	1188 b	3593 a	2258 a	2245 a	2004 a	2145 a	2593 a	2367 b
ProPulse 8.6 fl oz/ac	2898 a	1652 ab	4179 a	2679 a	2738 a	2793 a	2502 a	3085 a	2816 a
ProPulse 10.3 fl oz/ac	3191 a	1741 a	4435 a	2895 a	2770 a	2608 a	2484 a	2813 a	2867 a
CV:	12.4	14.1	0.72	11.1			22.3	7.7	5.6

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Topsin: active ingredient, thiophanate-methyl (FRAC 1) ProPulse: prothioconazole (FRAC 3) + fluopyram (FRAC 7)

Efficacy of Topsin, 40 fl oz/ac versus ProPulse, 10.3 fl oz/ac

Two sequential applications of the same fungicide (early bloom/pin-pod + 6, 7, or 13 days apart)

location	Carrington	Langdon	Carrington	Carrington	COMBINED ANALYSIS 4 studies	Read the label for Topsin/generic carefully. The language on the labels for some versions of Topsin/generic is vague and appears to permit two applications to dry edible beans at 40 fl oz/ac. The language on the labels for other versions of generic Topsin indicates an application rate of 30-40 fl oz/ac when making a single application to dry beans and 20-30 fl oz/ac when making multiple applications.
year	2012	2012	2024	2023		
days between applications	13	13	7	6		
nozzles, pressure, first fungicide application	XR8001 35 psi	AI11002 40 psi	DG110015 30 psi	DG110015 30 psi		
nozzles, pressure, 2 nd fungicide application	XR8001 35 psi	AI11002 40 psi	AIXR110015 60 psi	AIXR110015 60 psi		
droplet size, applic. #1	fine	extra coarse	medium	medium		
droplet size, applic. #2	fine	extra coarse	coarse	coarse		
market class	pinto	pinto	pinto	pinto		
variety	'Maverick'	'Maverick'	'Vibrant'	'Vibrant'		
row spacing	30 inches	30 inches	14 inches	14 inches		
WHITE MOLD SEVERITY (% of canopy)					White mold (%)	
Non-treated control	24 a	36 a	70 a	73 b	51 b	
Topsin 40 fl oz/ac	5 a	22 a	56 a	49 a	33 a	
ProPulse 10.3 fl oz/ac	6 a	17 a	62 a	58 ab	36 a	
CV:	78.4		10.5	16.1	9.4	
YIELD (lbs/ac)					Yield (lbs/ac)	
Non-treated control	2906 a	3593 a	1226 b	1247 b	2243 b	
Topsin 40 fl oz/ac	3421 a	4399 a	2038 a	2351 a	3052 a	
ProPulse 10.3 fl oz/ac	3191 a	4435 a	1736 ab	1958 a	2830 a	
CV:	12.4		16.0	17.1	5.9	

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Topsin 30 fl oz/ac versus ProPulse 10.3 fl oz/ac

Two sequential applications of the same fungicide (early bloom/pin-pod + 12 or 13 days apart)

location	Carrington	Langdon	Langdon	Carrington	Carrington	Carrington	Carrington	COMBINED ANALYSIS 7 studies
year	2012	2014	2012	2014	2020	2014	2022	
days between applications	13	12	13	12	13	12	12	
nozzles, pressure, first fungicide application	XR8001 35 psi	XR8001 40 psi	AI11002 40 psi	XR8001 35 psi	AIXR110015 60 psi	XR8001 35 psi	DG110015 40 psi	
nozzles, pressure, 2 nd fungicide application	XR8001 35 psi	XR8001 40 psi	AI11002 40 psi	XR8001 35 psi	AIXR110015 50 psi	XR8001 35 psi	AIXR110015 60 psi	
droplet size, applic. #1	fine	fine	extra coarse	fine	medium	fine	fine	
droplet size, applic. #2	fine	fine	extra coarse	fine	medium	fine	medium	
market class	pinto	pinto	pinto	pinto	pinto	pinto	pinto	
variety	'Maverick'	'Lariat'	'Maverick'	'Lariat'	'Palomino'	'Lariat'	'Lariat'	
row spacing	30 inches	30 inches	30 inches	14 inches	14 inches	14 inches	14 inches	
WHITE MOLD SEVERITY (% of canopy)								
Non-treated control	24 a	33 a	36 a	72 b	74 a	83 b	90 a	59 b
Topsin 30 fl oz/ac	5 a	14 a	21 a	46 a	71 a	59 a	81 a	42 a
ProPulse 10.3 fl oz/ac	6 a	25 a	17 a	50 a	68 a	62 a	81 a	44 a
CV:	78.4	20.5		9.0	16.4	13.9	8.1	9.7
YIELD (lbs/ac)								Yield (lbs/ac)
Non-treated control	2906 a	1188 b	3593 a	2245 b	1842 a	2004 a	1498 b	2182 b
Topsin 30 fl oz/ac	3174 a	1944 a	3916 a	2924 a	2170 a	2657 a	2104 a	2699 a
ProPulse 10.3 fl oz/ac	3191 a	1741 a	4435 a	2770 ab	2369 a	2608 a	2162 a	2754 a
CV:	12.4	14.1			18.4	0.7	17.2	5.8

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Topsin 30 fl oz/ac versus ProPulse 8.6 fl oz/ac

Two sequential applications of the same fungicide (early bloom/pin-pod + 12 or 13 days apart)

location	Carrington	Langdon	Langdon	Carrington	Carrington	Carrington	Carrington	COMBINED ANALYSIS 7 studies
year	2012	2014	2012	2012	2014	2014	2014	
days between applications	13	12	13	13	12	12	13	
nozzles, pressure, first fungicide application	XR8001 35 psi	XR8001 40 psi	AI11002 40 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	
nozzles, pressure, 2 nd fungicide application	XR8001 35 psi	XR8001 40 psi	AI11002 40 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	
droplet size, applic. #1	fine	fine	extra coarse	fine	fine	fine	fine	
droplet size, applic. #2	fine	fine	extra coarse	fine	fine	fine	fine	
market class	pinto	pinto	pinto	pinto	pinto	pinto	pinto	
variety	'Maverick'	'Lariat'	'Maverick'	'Othello'	'Lariat'	'Lariat'	'ND-307'	
row spacing	30 inches	30 inches	30 inches	14 inches	14 inches	14 inches	14 inches	
WHITE MOLD SEVERITY (% of canopy)								
Non-treated control	24 b	33 a	36 a	46 a	72 b	83 b	74 b	53 b
Topsin 30 fl oz/ac	5 ab	14 a	21 a	35 a	46 a	59 a	61 ab	34 a
ProPulse 8.6 fl oz/ac	2 a	23 a	20 a	43 a	57 ab	65 ab	48 a	37 a
CV:	78.4	20.5		35.3	9.0	13.9	14.9	12.3
YIELD (lbs/ac)								Yield (lbs/ac)
Non-treated control	2906 a	1188 b	3593 a	2271 a	2245 b	2004 a	1992 a	2314 b
Topsin 30 fl oz/ac	3174 a	1944 a	3916 a	2602 a	2924 a	2657 a	2308 a	2789 a
ProPulse 8.6 fl oz/ac	2898 a	1652 ab	4179 a	2291 a	2738 ab	2793 a	2474 a	2718 a
CV:	12.4	14.1		19.6			10.8	6.9

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Endura: active ingredient, boscalid (FRAC 7) ProPulse: prothioconazole (FRAC 3) + fluopyram (FRAC 7)

Endura 8 oz versus ProPulse 8.6 fl oz

Two sequential applications of the same fungicide (early bloom/pin-pod + 11, 12, or 13 days apart)

location	Carrington	Langdon	Langdon	Carrington	Carrington	Carrington	Carrington	Carrington	Carrington	Carrington	COMBINED ANALYSIS 10 studies	
year	2012	2014	2012	2012	2013	2014	2014	2014	2023	2023		
days between applications	13	12	13	13	11	12	12	13	13	13		
nozzles, pressure, first fungicide application	XR8001 35 psi	XR8001 40 psi	AI11002 40 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	DG110015 30 psi	DG110015 30 psi		
nozzles, pressure, 2 nd fungicide application	XR8001 35 psi	XR8001 40 psi	AI11002 40 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	AIXR110015 60 psi	AIXR110015 60 psi		
droplet size, applic. #1	fine	fine	extra coarse	fine	fine	fine	fine	fine	medium	medium		
droplet size, applic. #2	fine	fine	extra coarse	fine	fine	fine	fine	fine	medium	medium		
market class	pinto	pinto	pinto	pinto	pinto	pinto	pinto	pinto	DR kidney	pinto		
variety	'Maverick'	'Lariat'	'Maverick'	'Othello'	'Lariat'	'Lariat'	'Lariat'	'Lariat'	'ND-307'	'Red hawk'		'Vibrant'
row spacing	30 inches	30 inches	30 inches	14 inches	14 inches	14 inches	14 inches	14 inches	14 inches	14 inches		
WHITE MOLD SEVERITY (% of canopy)											White mold (%)	
Non-treated control	24 b	33 a	36 a	46 b	55 a	72 b	83 b	74 b	34 a	65 a	52 b	
Endura 8.0 oz/ac	2 a	12 a	25 a	10 a	33 a	48 a	51 a	63 ab	22 a	50 a	32 a	
ProPulse 8.6 fl oz/ac	2 a	23 a	20 a	43 ab	47 a	57 ab	65 ab	48 a	26 a	56 a	39 a	
CV:	78.4	20.5	2.24	35.3	18.0	9.0	13.9	14.9	42.8	4.9	16.8	
YIELD (lbs/ac)											Yield (lbs/ac)	
Non-treated control	2906 a	1188 b	3593 a	2271 a	2258 b	2245 b	2004 b	1992 a	2579 a	1963 a	2300 b	
Endura 8.0 oz/ac	3154 a	1844 a	4115 a	3009 a	3296 a	3088 a	2819 a	2151 a	2994 a	2774 a	2924 a	
ProPulse 8.6 fl oz/ac	2898 a	1652 ab	4179 a	2291 a	2679 ab	2738 ab	2793 ab	2474 a	3037 a	2664 a	2741 a	
CV:	12.4	14.1		19.6	11.1			10.8	9.5	16.3	7.6	

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Endura: active ingredient, boscalid (FRAC 7) Topsin: thiophanate-methyl (FRAC 1) ProPulse: prothioconazole (FRAC 3) + fluopyram (FRAC 7)

Topsin 30 fl oz/ac rotated with ProPulse 10.3 fl oz/ac or Endura 8 oz/ac

Two-application fungicide program (early bloom/pin-pod + 7, 10, 12, or 14 days apart)

	location	Carrington	Carrington	Carrington	Carrington	Carrington	Carrington	Carrington	Carrington
	year	2014	2015	2017	2019	2021	2022	2023	2023
	days between applications	12	12	10	14	10	12	12	7
nozzles, pressure, first fungicide application	XR8001	XR80015	DG80015	AIXR110015	DG110015	DG110015	DG110015	DG110015	DG110015
	35 psi	35 psi	35 psi	50 psi	30 psi	40 psi	30 psi	30 psi	30 psi
nozzles, pressure, 2 nd fungicide application	XR8001	XR80015	DG80015	XR11002	DG110015	AIXR110015	AIXR110015	AIXR110015	AIXR110015
	35 psi	35 psi	35 psi	30 psi	30 psi	60 psi	60 psi	60 psi	60 psi
	droplet size, applic. #1	fine	fine	medium	medium	medium	fine	medium	medium
	droplet size, applic. #2	fine	fine	medium	fine	medium	medium	medium	medium
	market class	pinto	pinto	pinto	pinto	pinto	pinto	pinto	pinto
	variety	'ND-307'	'ND-307'	'La Paz'	'Palomino'	'Palomino'	'Lariat'	'Vibrant'	'Vibrant'
	row spacing	14 inches	28 inches	14 inches	14 inches	14 inches	14 inches	14 inches	14 inches
WHITE MOLD SEVERITY (% of canopy)									
	Non-treated control	78 b	7 a	38 a	33 b	10 a	89 a	62 a	73 b
	Topsin 30 fl oz/ac / Endura 8 oz/ac	43 a	4 a	30 a	16 a	6 a	87 a	54 a	59 a
	Topsin 30 fl oz / ProPulse 10.3 fl oz/ac	40 a	6 a	26 a	9 a	5 a	89 a	53 a	60 a
	CV:	16.8	62.4	32.2	29.1	56.1	11.6	15.5	9.3
YIELD (lbs/ac)									
	Non-treated control	2593 b	1904 a	1948 b	3149 b	2967 a	1144 b	2174 a	1104 b
	Topsin 30 fl oz/ac / Endura 8 oz/ac	3247 a	2230 a	2311 ab	3599 ab	2877 a	1388 a	2763 a	1842 a
	Topsin 30 fl oz / ProPulse 10.3 fl oz/ac	3495 a	2128 a	2722 a	3743 a	2956 a	1231 ab	2724 a	1821 a
	CV:	7.7	10.2	15.5	7.1	9.0	3.1	12.0	16.9
White mold (%)			Yield (lbs/ac)			COMBINED ANALYSIS 8 studies			
Non-treated control		49 b		2123 b					
Topsin 30 fl oz/ac / Endura 8 oz/ac		37 a		2532 a					
Topsin 30 fl oz / ProPulse 10.3 fl oz/ac		36 a		2602 a					
	CV:	17.3		7.9					

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Endura: active ingredient, boscalid (FRAC 7) Topsin: thiophanate-methyl (FRAC 1) ProPulse: prothioconazole (FRAC 3) + fluopyram (FRAC 7)

Topsin 30 fl oz/ac rotated with ProPulse 10.3 fl oz/ac

Two-application fungicide program (early bloom/pin-pod + 7, 10, 12, or 14 days apart)

	location	Carrington	Carrington	Carrington	Carrington	Carrington	Carrington	COMBINED ANALYSIS 6 studies
	year	2015	2017	2019	2022	2023	2023	
	days between applications	12	10	14	12	12	7	
nozzles, pressure, first fungicide application	XR8001 35 psi	DG80015 35 psi	AIXR110015 50 psi	DG110015 40 psi	DG110015 30 psi	DG110015 30 psi		
nozzles, pressure, 2 nd fungicide application	XR8001 35 psi	DG80015 35 psi	XR11002 30 psi	AIXR110015 60 psi	AIXR110015 60 psi	AIXR110015 60 psi		
droplet size, applic. #1 fine		medium	medium	fine	medium	medium		
droplet size, applic. #2 fine		medium	fine	medium	medium	medium		
market class pinto		pinto	pinto	pinto	pinto	pinto		
variety 'ND-307'		'La Paz'	'Palomino'	'Lariat'	'Vibrant'	'Vibrant'		
row spacing	28 inches	14 inches	14 inches	14 inches	14 inches	14 inches		
WHITE MOLD SEVERITY (% of canopy)								White mold (%)
Non-treated control	7 a	38 a	33 c	89 a	62 b	73 b		50 b
Topsin 30 fl oz/ac / Endura 8 oz/ac	4 a	30 a	16 ab	87 a	54 ab	59 a		42 a
Topsin 30 fl oz / ProPulse 10.3 fl oz/ac	6 a	26 a	9 a	89 a	53 ab	60 a		40 a
ProPulse 10.3 fl oz / Topsin 30 fl oz/ac	3 a	23 a	23 bc	87 a	42 a	59 a		40 a
CV:	62.4	32.2	29.1	11.6	15.5	9.3		11.3
YIELD (lbs/ac)								Yield (lbs/ac)
Non-treated control	1904 a	1948 b	3149 b	1144 b	2174 b	1104 b		1904 b
Topsin 30 fl oz/ac / Endura 8 oz/ac	2230 a	2311 ab	3599 ab	1388 a	2763 ab	1842 a		2356 a
Topsin 30 fl oz / ProPulse 10.3 fl oz/ac	2128 a	2722 a	3743 a	1231 ab	2724 ab	1821 a		2395 a
ProPulse 10.3 fl oz / Topsin 30 fl oz/ac	2175 a	2655 ab	3509 ab	1339 ab	3204 a	1940 a		2470 a
CV:	10.2	15.5	7.1	3.1	12.0	16.9		7.8

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ProPulse: active ingredients, fluopyram (FRAC 7) + prothioconazole (FRAC 3) Omega: active ingredient, fluazinam (FRAC 29)

ProPulse (10.3 fl oz) versus Omega (13.6 fl oz)

Two sequential applications of the same fungicide (early bloom/pin-pod + 12, 13 or 14 days apart)

	location Carrington	Langdon	Langdon	Carrington	Carrington	Carrington	Carrington	COMBINED ANALYSIS 7 studies
year	2012	2014	2012	2013	2013	2014	2014	
days between applications	13	12	13	14	14	12	12	
nozzles, pressure, first fungicide application	XR8001 35 psi	XR8001 40 psi	AI11002 40 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	
nozzles, pressure, 2 nd fungicide application	XR8001 35 psi	XR8001 40 psi	AI11002 40 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	
droplet size, applic. #1	fine	fine	extra-coarse	fine	fine	fine	fine	
droplet size, applic. #2	fine	fine	extra-coarse	fine	fine	fine	fine	
market class	pinto	pinto	pinto	pinto	pinto	pinto	pinto	
variety	'Maverick'	'Lariat'	'Maverick'	'Lariat'	'Lariat'	'Lariat'	'Lariat'	
row spacing	30 inches	30 inches	30 inches	28 inches	14 inches	14 inches	14 inches	
WHITE MOLD SEVERITY (% of canopy)								White mold (%)
Non-treated control	24 a	33 b	36 a	45 b	54 b	72 c	83 c	50 b
ProPulse 10.3 fl oz/ac	6 a	25 ab	17 a	30 a	30 a	50 b	62 b	31 a
Omega 13.6 fl oz/ac	10 a	10 a	21 a	23 a	36 a	31 a	33 a	24 a
CV:	78.4	20.5	2.24	31.1	32.7	9.0	13.9	23.8
YIELD (lbs/ac)								Yield (lbs/ac)
Non-treated control	2906 a	1188 b	3593 a	1949 b	1984 b	2245 b	2004 b	2267 b
ProPulse 10.3 fl oz/ac	3191 a	1741 a	4435 a	2549 a	2802 a	2770 b	2608 b	2871 a
Omega 13.6 fl oz/ac	3685 a	1929 a	3632 a	2701 a	2783 a	3370 a	3444 a	3078 a
CV:	12.4	14.1		9.9	9.4			10.6

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ProPulse: active ingredients, fluopyram (FRAC 7) + prothioconazole (FRAC 3) Omega: active ingredient, fluazinam (FRAC 29)

ProPulse (8.6 fl oz) versus Omega (13.6 fl oz)

Two sequential applications of the same fungicide (early bloom/pin-pod + 12 or 13 days apart)

location	Carrington	Langdon	Langdon	Carrington	Carrington	Carrington	Carrington	Carrington	COMBINED ANALYSIS 8 studies
year	2012	2014	2012	2012	2014	2014	2023	2023	
days between applications	13	12	13	13	12	12	13	13	
nozzles, pressure, first fungicide application	XR8001 35 psi	XR8001 40 psi	AI11002 40 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	DG110015 30 psi	DG110015 30 psi	
nozzles, pressure, 2 nd fungicide application	XR8001 35 psi	XR8001 40 psi	AI11002 40 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	AIXR110015 60 psi	AIXR110015 60 psi	
droplet size, applic. #1	fine	fine	extra-coarse	fine	fine	fine	medium	medium	
droplet size, applic. #2	fine	fine	extra-coarse	fine	fine	fine	coarse	coarse	
market class	pinto	pinto	pinto	pinto	pinto	pinto	DR kidney	pinto	
variety	'Maverick'	'Lariat'	'Maverick'	'Othello'	'Lariat'	'Lariat'	'Red hawk'	'Vibrant'	
row spacing	30 inches	30 inches	30 inches	14 inches	14 inches	14 inches	14 inches	14 inches	
WHITE MOLD SEVERITY (% of canopy)									White mold (%)
Non-treated control	24 b	33 b	36 a	46 a	72 b	83 b	34 a	65 b	49 c
ProPulse 8.6 fl oz/ac	2 a	23 ab	20 a	43 a	57 b	65 b	26 a	56 ab	37 b
Omega 13.6 fl oz/ac	10 ab	10 a	21 a	30 a	31 a	33 a	13 a	41 a	24 a
CV:	78.4	20.5	2.24	35.3	9.0	13.9	42.8	4.9	21.7
YIELD (lbs/ac)									Yield (lbs/ac)
Non-treated control	2906 a	1188 b	3593 a	2271 a	2245 b	2004 b	2579 b	1963 b	2344 b
ProPulse 8.6 fl oz/ac	2898 a	1652 ab	4179 a	2291 a	2738 b	2793 ab	3037 ab	2664 ab	2782 a
Omega 13.6 fl oz/ac	3685 a	1929 a	3632 a	2310 a	3370 a	3444 a	3182 a	3018 a	3071 a
CV:	12.4	14.1		19.6			9.5	16.3	10.8

Comparative fungicide efficacy: Management of white mold in dry edible beans

North Dakota State Univ. Carrington Research Extension Center; Michael Wunsch, Jesse Hafner, Suanne Kallis, Aaron Fauss, Michael Schaefer, Thomas Miorino, Billy Kraft

Endura: active ingredient, boscalid (FRAC 7) Omega: fluazinam (FRAC 29)

Topsin: thiophanate-methyl (FRAC 1) ProPulse: prothioconazole (FRAC 3) + fluopyram (FRAC 7)

Omega 8 or 13.6 fl oz versus Endura 8 oz, Topsin 30 fl oz, ProPulse 10.3 fl oz

Two sequential applications of the same fungicide (early bloom/pin-pod + 12 days apart)

location	Langdon	Carrington	Carrington	COMBINED ANALYSIS 3 studies
year	2014	2014	2014	
days between applications	12	12	12	
nozzles, pressure, 1 st application	XR8001, 40 psi	XR8001, 35 psi	XR8001, 35 psi	
nozzles, pressure, 2 nd application	XR8001, 40 psi	XR8001, 35 psi	XR8001, 35 psi	
droplet size	fine	fine	fine	
variety	'Lariat' pinto	'Lariat' pinto	'Lariat' pinto	
row spacing	30 inches	14 inches	14 inches	
WHITE MOLD SEVERITY (% of canopy)				White mold (%)
Non-treated control	33 b	72 c	83 c	63 c
ProPulse 10.3 fl oz/ac	25 ab	50 b	62 b	46 b
Topsin 30 fl oz/ac	14 ab	46 ab	59 b	40 ab
Omega 8 fl oz/ac	13 ab	40 ab	57 b	37 ab
Endura 8 oz/ac	12 ab	48 ab	51 ab	37 ab
Omega 13.6 fl oz/ac	10 a	31 a	33 a	25 a
CV:	20.5	9.0	13.9	13.2
YIELD (lbs/ac)				Yield (lbs/ac)
Non-treated control	1188 b	2245 c	2004 c	1813 c
ProPulse 10.3 fl oz/ac	1741 a	2770 bc	2608 bc	2373 b
Topsin 30 fl oz/ac	1944 a	2924 ab	2657 abc	2508 ab
Omega 8 fl oz/ac	1646 ab	3122 ab	2763 abc	2510 ab
Endura 8 oz/ac	1844 a	3088 ab	2819 ab	2584 ab
Omega 13.6 fl oz/ac	1929 a	3370 a	3444 a	2914 a
CV:	14.1			6.5

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Topsin: thiophanate-methyl (FRAC 1) Badge SC: copper oxychloride + copper hydroxide ProPulse: fluopyram (FRAC 7) + prothioconazole (FRAC 3)

Topsin, Propulse applied with and without Badge				
Two sequential applications of the same fungicide (early bloom/pin-pod + 12 or 13 days apart)	location, year	Carrington, 2020	Carrington, 2022	COMBINED ANALYSIS 2 studies
	days between applications	13	12	
	nozzles, pressure, 1st app.	AIXR110015, 60 psi	DG110015, 40 psi	
	nozzles, pressure, 2 nd app.	AIXR110015, 50 psi	AIXR110015, 60 psi	
	droplet size, app. #1, #2	medium, medium	fine, medium	
variety		'Palomino' pinto	'Lariat' pinto	
row spacing		14 inches	14 inches	
Topsin (30 fl oz/ac) applied with and without Badge				
Topsin (30 fl oz/ac) applied with and without Badge	WHITE MOLD SEVERITY (% of canopy)			
	Non-treated control	74 a	90 b	82 b
	Topsin 30 fl oz/ac	71 a	81 ab	76 ab
	Topsin 30 fl oz + Badge 2 pt/ac	60 a	74 a	67 a
	CV:	16.4	8.1	2.7
	YIELD (lbs/ac)			
	Non-treated control	1842 a	1498 b	1670 b
	Topsin 30 fl oz/ac	2170 a	2104 a	2137 ab
	Topsin 30 fl oz + Badge 2 pt/ac	2455 a	2451 a	2453 a
	CV:	18.4	17.2	6.1
ProPulse (10.3 fl oz/ac) applied with and without Badge				
ProPulse (10.3 fl oz) applied with and without Badge	WHITE MOLD SEVERITY (% of canopy)			
	Non-treated control	74 a	90 a	82 a
	ProPulse 10.3 fl oz/ac	68 a	81 a	74 a
	ProPulse 10.3 fl oz + Badge 2 pt/ac	69 a	85 a	77 a
	CV:	16.4	8.1	2.0
	YIELD (lbs/ac)			
	Non-treated control	1842 a	1498 b	1670 b
	ProPulse 10.3 fl oz/ac	2369 a	2162 a	2265 a
	ProPulse 10.3 fl oz + Badge 2 pt/ac	2381 a	1841 ab	2111 a
	CV:	18.4	17.2	5.9

Comparative fungicide efficacy: Management of white mold in dry edible beans

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Endura: boscalid (FRAC 7) ProPulse: prothioconazole (FRAC 3) + fluopyram (FRAC 7)

Miravis Neo: azoxystrobin (FRAC 11), propiconazole (FRAC 3), pydiflumetofen (FRAC 7)

Miravis Neo (13.7 fl oz) versus ProPulse (10.3 fl oz), Endura (8 oz)

Two sequential applications of the same fungicide (early bloom/pin-pod + 13 or 14 days apart)

	location Carrington	Carrington	Carrington	Carrington	COMBINED ANALYSIS 4 studies
year	2022	2022	2023	2024	
canopy closure, 1 st application	95-97%	90-95%	90-95%	85-95%	
days between applications	14	14	12	7	
nozzles, pressure, 1 st applic.	DG110015, 40 psi	DG110015, 40 psi	DG110015, 30 psi	DG110015, 30 psi	
nozzles, pressure, 2 nd applic.	AIXR110015, 60 psi	AIXR110015, 60 psi	AIXR110015, 60 psi	AIXR110015, 60 psi	
droplet size	fine, medium	fine, medium	medium, medium	medium, medium	
variety	'Lariat' pinto	'Rosie' LR Kidney	'Vibrant' pinto	'Vibrant' pinto	
row spacing	14 inches	14 inches	14 inches	14 inches	
WHITE MOLD SEVERITY (% of canopy)					White mold (%)
Non-treated control	92 b	60 b	56 a	70 a	70 b
Endura 8.0 oz/ac	83 a	37 a	44 a	66 a	58 a
ProPulse 10.3 fl oz/ac	88 ab	46 a	30 a	62 a	57 a
Miravis Neo 13.7 fl oz/ac	92 b	64 b	55 a	66 a	69 b
CV:	4.8	14.2	26.3	10.5	10.4
YIELD (lbs/ac)					Yield (lbs/ac)
Non-treated control	1286 b	2267 b	2327 c	1226 a	1776 b
Endura 8.0 oz/ac	2147 a	3010 a	3128 ab	1578 a	2466 a
ProPulse 10.3 fl oz/ac	1745 ab	2702 a	3426 a	1736 a	2402 a
Miravis Neo 13.7 fl oz/ac	1361 b	2209 b	2555 bc	1478 a	1901 b
CV:	16.4	7.4	14.8	16.0	9.3

Comparative fungicide efficacy: Management of white mold in dry edible beans

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Proline: active ingredient,prothioconazole (FRAC 3) ProPulse: prothioconazole (FRAC 3) + fluopyram (FRAC 7)

Proline 5.7 fl oz versus ProPulse 10.3 fl oz

Two sequential applications of the same fungicide (early bloom/pin-pod + 6, 7, 10, 11, 12, 13, or 14 days apart)

location	Carrington	Langdon	Carrington	Carrington	Carrington	Carrington	Carrington	Carrington	COMBINED ANALYSIS 8 studies
year	2012	2012	2013	2013	2013	2009	2010	2014	
days between applications	13	13	14	14	11	7	11	12	
nozzles, pressure, first fungicide application	XR8001 35 psi	AI11002 40 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	TJ60-8002 35 psi	XR80015 35 psi	XR8001 35 psi	
nozzles, pressure, 2 nd fungicide application	XR8001 35 psi	AI11002 40 psi	XR8001 35 psi	XR8001 35 psi	XR8001 35 psi	TJ60-8002 35 psi	XR80015 35 psi	XR8001 35 psi	
droplet size, applic. #1	fine	extra coarse	fine	fine	fine	very fine	fine	fine	
droplet size, applic. #2	fine	extra coarse	fine	fine	fine	very fine	fine	fine	
market class	pinto	pinto	pinto	pinto	pinto	pinto	pinto	pinto	
variety	'Maverick'	'Maverick'	'Lariat'	'Lariat'	'Lariat'	'Lariat'	'Lariat'	'ND-307'	White mold (%)
row spacing	30 inches	30 inches	28 inches	14 inches	14 inches	15 inches	15 inches	14 inches	
WHITE MOLD SEVERITY (% of canopy)									
Non-treated control	24 a	36 a	45 b	54 b	55 a	100 b	73 b	78 a	
ProPulse 10.3 fl oz/ac	6 a	17 a	30 a	30 a	44 a	63 a	53 a	69 a	
Proline 5.7 fl oz/ac	14 a	29 a	46 b	43 ab	52 a	70 a	61 a	71 a	
CV:	78.4	2.24	31.1	32.7	18.0	11.8		16.8	
YIELD (lbs/ac)									
Non-treated control	2906 a	3593 a	1949 b	1984 c	2258 a	1015 c	2145 a	2593 a	2305 b
ProPulse 10.3 fl oz/ac	3191 a	4435 a	2549 a	2802 a	2895 a	2271 a	2484 a	2813 a	2930 a
Proline 5.7 fl oz/ac	3428 a	4012 a	2309 a	2379 b	2441 a	1708 b	2776 a	2733 a	2723 a
CV:	12.4	0.72	9.9	9.4	11.1	13.3	22.3	7.7	7.9

Comparative fungicide efficacy: Management of white mold in dry edible beans

NDSU Carrington Research Extension Center; Michael Wunsch, Jesse Hafner, Suanne Kallis, Aaron Fauss, Michael Schaefer, Thomas Miorino, Billy Kraft

Proline: active ingredient, prothioconazole (FRAC 3) ProPulse: prothioconazole (FRAC 3) + fluopyram (FRAC 7)

Proline 5.7 fl oz versus ProPulse 8.6 fl oz

Two sequential applications of the same fungicide (early bloom/pin-pod + 6, 7, 10, 11, 12, 13, or 14 days apart)

location	Carrington	Langdon	Carrington	Carrington	Carrington	Carrington	COMBINED ANALYSIS 6 studies
year	2012	2012	2012	2013	2010	2014	
days between applications	13	13	13	11	11	12	
nozzles, pressure, first fungicide application	XR8001 35 psi	AI11002 40 psi	XR8001 35 psi	XR8001 35 psi	XR80015 35 psi	XR8001 35 psi	
nozzles, pressure, 2 nd fungicide application	XR8001 35 psi	AI11002 40 psi	XR8001 35 psi	XR8001 35 psi	XR80015 35 psi	XR8001 35 psi	
droplet size, applic. #1	fine	extra coarse	fine	fine	fine	fine	
droplet size, applic. #2	fine	extra coarse	fine	fine	fine	fine	
market class	pinto	pinto	pinto	pinto	pinto	pinto	
variety	'Maverick'	'Maverick'	'Othello'	'Lariat'	'Lariat'	'ND-307'	
row spacing	30 inches	30 inches	14 inches	14 inches	15 inches	14 inches	
WHITE MOLD SEVERITY (% of canopy)							White mold (%)
Non-treated control	24 b	36 a	46 b	55 a	73 b	78 a	52 b
ProPulse 8.6 fl oz/ac	2 a	20 a	43 ab	47 a	57 a	66 a	39 a
Proline 5.7 fl oz/ac	14 ab	29 a	53 b	52 a	61 a	71 a	47 b
CV:	78.4	2.24	35.3	18.0		16.8	8.6
YIELD (lbs/ac)							Yield (lbs/ac)
Non-treated control	2906 a	3593 a	2271 a	2258 b	2145 a	2593 a	2628 a
ProPulse 8.6 fl oz/ac	2898 a	4179 a	2291 a	2679 ab	2502 a	3085 a	2939 a
Proline 5.7 fl oz/ac	3428 a	4012 a	1982 a	2441 b	2776 a	2733 a	2895 a
CV:	12.4	0.72	19.6	11.1	22.3	7.7	8.0

Comparative fungicide efficacy: Management of white mold in dry edible beans

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Endura: active ingredient, boscalid (FRAC 7) Quash: metconazole (FRAC 3) ProPulse: prothioconazole (FRAC 3) + fluopyram (FRAC 7)

Quash (2.5 oz) versus Endura (8 oz), ProPulse (10.3 fl oz)

Two sequential applications of the same fungicide (early bloom/pin-pod + 13 or 14 days apart)

	location Carrington	Langdon	Carrington	Carrington	COMBINED ANALYSIS 4 studies
	year 2012	2012	2013	2013	
days between applications	13	13	14	14	
nozzles, pressure, 1 st applic.	XR8001, 35 psi	AI11002, 40 psi	XR8001, 35 psi	XR8001, 35 psi	
nozzles, pressure, 2 nd applic.	XR8001, 35 psi	AI11002, 40 psi	XR8001, 35 psi	XR8001, 35 psi	
droplet size	fine	extra-coarse	fine	fine	
variety	'Maverick' pinto	'Maverick' pinto	'Lariat' pinto	'Lariat' pinto	
row spacing	30 inches	30 inches	28 inches	14 inches	
WHITE MOLD SEVERITY (% of canopy)					White mold (%)
Non-treated control	24 b	36 a	45 b	54 c	40 b
Endura 8.0 oz/ac	2 a	25 a	37 ab	28 a	23 a
ProPulse 10.3 fl oz/ac	6 ab	17 a	30 a	30 ab	21 a
Quash 2.5 oz/ac	17 ab	40 a	43 ab	45 bc	36 b
CV:	78.4	2.24	31.1	32.7	13.8
YIELD (lbs/ac)					Yield (lbs/ac)
Non-treated control	2906 a	3593 a	1949 b	1984 b	2608 b
Endura 8.0 oz/ac	3154 a	4115 a	2656 a	2789 a	3178 a
ProPulse 10.3 fl oz/ac	3191 a	4435 a	2549 a	2802 a	3244 a
Quash 2.5 oz/ac	3057 a	3770 a	1995 b	2183 b	2751 b
CV:	12.4	0.72	9.9	9.4	5.3

Comparative fungicide efficacy: Management of white mold in dry edible beans

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Active ingredients Rovral: iprodione (FRAC 2) Switch: cyprodinil (FRAC 12), fludioxonil (FRAC 9)

Endura: boscalid (FRAC 7) ProPulse: prothioconazole (FRAC 3) + fluopyram (FRAC 7)

Rovral (2 pt), Switch (14 oz) versus Endura (8 oz), ProPulse (10.3 fl oz)

Two sequential applications of the same fungicide (early bloom/pin-pod + 13 or 14 days apart)

	location Carrington	Langdon	Carrington	Carrington	COMBINED ANALYSIS 4 studies
	year 2012	2012	2013	2013	
days between applications	13	13	14	14	
nozzles, pressure, 1 st applic.	XR8001, 35 psi	AI11002, 40 psi	XR8001, 35 psi	XR8001, 35 psi	
nozzles, pressure, 2 nd applic.	XR8001, 35 psi	AI11002, 40 psi	XR8001, 35 psi	XR8001, 35 psi	
droplet size	fine	extra-coarse	fine	fine	
variety	'Maverick' pinto	'Maverick' pinto	'Lariat' pinto	'Lariat' pinto	
row spacing	30 inches	30 inches	28 inches	14 inches	
WHITE MOLD SEVERITY (% of canopy)					White mold (%)
Non-treated control	24 b	36 a	45 b	54 b	40 b
Endura 8.0 oz/ac	2 a	25 a	37 b	28 a	23 a
ProPulse 10.3 fl oz/ac	6 ab	17 a	30 a	30 a	21 a
Rovral 2.0 pt/ac	7 ab	30 a	37 ab	36 a	27 a
Switch 14 oz/ac	5 a	32 a	26 a	41 a	26 a
CV:	78.4	2.24	31.1	32.7	17.7
YIELD (lbs/ac)					Yield (lbs/ac)
Non-treated control	2906 a	3593 a	1949 b	1984 c	2608 b
Endura 8.0 oz/ac	3154 a	4115 a	2656 a	2789 a	3178 a
ProPulse 10.3 fl oz/ac	3191 a	4435 a	2549 a	2802 a	3244 a
Rovral 2.0 pt/ac	2966 a	4186 a	2472 a	2437 b	3015 a
Switch 14 oz/ac	3029 a	4065 a	2459 a	2362 b	2979 a
CV:	12.4		9.9	9.4	4.4

2. Fungicides and fungicide application rates that can only be applied once in-season

Testing was conducted with two sequential applications of Topsin/generic at 40 fl oz/ac in order to fit the testing within existing protocols in which products were applied twice sequentially.

Comparative efficacy results are provided for Topsin/generic at 40 fl oz/ac to help facilitate informed decisions for selecting products **for application once in-season, either as a single application or in rotation with another fungicide.**

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Topsin: active ingredient, thiophanate-methyl (FRAC 1) ProPulse: prothioconazole (FRAC 3) + fluopyram (FRAC 7)

Efficacy of Topsin, 40 fl oz/ac versus ProPulse, 10.3 fl oz/ac

Two sequential applications of the same fungicide (early bloom/pin-pod + 6, 7, or 13 days apart)

location	Carrington	Langdon	Carrington	Carrington	COMBINED ANALYSIS 4 studies	Read the label for Topsin/generic carefully. The language on the labels for some versions of Topsin/generic appears to permit two applications to dry edible beans at 40 fl oz/ac in the same season. The language on the labels for other versions of generic Topsin indicates an application rate of 30-40 fl oz/ac when making a single application to dry beans and 20-30 fl oz/ac when making multiple applications.
year	2012	2012	2024	2023		
days between applications	13	13	7	6		
nozzles, pressure, first fungicide application	XR8001 35 psi	AI11002 40 psi	DG110015 30 psi	DG110015 30 psi		
nozzles, pressure, 2 nd fungicide application	XR8001 35 psi	AI11002 40 psi	AIXR110015 60 psi	AIXR110015 60 psi		
droplet size, applic. #1	fine	extra coarse	medium	medium		
droplet size, applic. #2	fine	extra coarse	coarse	coarse		
market class	pinto	pinto	pinto	pinto		
variety	'Maverick'	'Maverick'	'Vibrant'	'Vibrant'		
row spacing	30 inches	30 inches	14 inches	14 inches		
WHITE MOLD SEVERITY (% of canopy)					White mold (%)	
Non-treated control	24 a	36 a	70 a	73 b	51 b	
Topsin 40 fl oz/ac	5 a	22 a	56 a	49 a	33 a	
ProPulse 10.3 fl oz/ac	6 a	17 a	62 a	58 ab	36 a	
CV:	78.4		10.5	16.1	9.4	
YIELD (lbs/ac)					Yield (lbs/ac)	
Non-treated control	2906 a	3593 a	1226 b	1247 b	2243 b	
Topsin 40 fl oz/ac	3421 a	4399 a	2038 a	2351 a	3052 a	
ProPulse 10.3 fl oz/ac	3191 a	4435 a	1736 ab	1958 a	2830 a	
CV:	12.4		16.0	17.1	5.9	



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