Evaluation of Fungicide Seed Treatments as Management Tools for Root Rot of Field Peas in North Dakota

Rubella. S. Goswami, Blaine G. Schatz, Febina M. Mathew, and Samuel G. Markell

Introduction

Root rots are of particular concern for field pea production in North Dakota, the largest producer of field peas (*Pisum sativum*) in the U.S. with a planting area exceeding 500,000 acres and a production value exceeding $100 million annually. Damage from root rot pathogens is being reported in all pea-growing areas of the state and is likely to increase as field peas become an established part of the landscape. Fungicide seed treatments have been used to manage root rot pathogens on field peas, but few trials have been done in North Dakota.

Objective

The objective of this study was to evaluate the efficacy of fungicidal seed treatments on field pea in North Dakota.

Materials and Methods

Four seed-treatment trials were established at the North Dakota State University (NDSU) Carrington Research Extension Center (CREC) near Carrington, ND, and at an on-farm location in Newburg, ND, in 2008 and 2009. Field pea cultivar D.S. Admiral was planted in seven row plots measuring approximately 1.5 m x 7.6 m on 5 and 19 May at CREC in 2008 and 2009, respectively, and on 7 and 21 May at Newburg, respectively. Planting rate was 300,000 pure live seeds acre^{-1} in 2008 and 330,000 pure live seeds acre^{-1} in 2009. Previous crop was spring wheat in all trials except CREC in 2009, where the previous crop was dry pea. Although the focus of the trial was root rots and fungicides, several insecticides were included.

Stand establishment was evaluated at least once at approximately 14 days post emergence by counting emerged plants in center two rows. Disease incidence and severity were assessed by randomly sampling ten plants approximately four weeks after emergence. Incidence was recorded as percent plants with root rot symptoms and severity was recorded as percent infection (visible lesions) on the taproot. Infected roots were washed, surface sterilized, and cultured and pathogens were identified using culture morphology and DNA sequencing. Plots were harvested at CREC on 6 and 18 August in 2008 and 2009, respectively, and at Newburg on 14 and 26 August, respectively. Yield, protein, test weight were evaluated after harvest. Data were analyzed using the Statistical Analysis Software (SAS Institute, Cary, NC) PROC ANOVA software (version 9.1).

Results and Discussion (data shown for 2009 trials; refer to CREC website for a full report)

Root rot was observed in all trials but was more severe at Newburg in both years. Several *Fusarium* species (mainly, *Fusarium oxysporum, Fusarium redolens, Fusarium avenaceum, Fusarium acuminatum, Fusarium graminearum*) and *Rhizoctonia solani* (AG-4) were identified in each location year. Statistical differences between non-treated controls and chemical seed treatments were observed in multiple parameters in multiple trials. A yield increase over the non-treated control(s) were observed in CREC in 2008 and 2009, and although statistical differences were not observed, yield of non-treated controls at Newburg in 2008 accounted for two of the lowest three values. Although fungicide seed treatments resulted in a yield increase over the non-treated control, two fungicide/insecticide combination treatments yielded significantly higher than fungicide-only treatments in CREC 2009. Insect damage was not evaluated.

Treatment Name	Product/AI Rate	Newberg 2009								
		Plant Stand	Root Rot	Root Rot Severity (% root infection)	Yield	Test Weight	Seed Protein	Root Rot Pathogens / treatment		
		plants ft^{-2}	Incidence		(bu/A)	lb/bu	%	*Fusarium* spp.	*Rhizoctonia* spp.	Unknown
Nontreated	NA	5.9	67.5	31.4	63.3	65.4	21	8	1	3
Cruiser Maxx Beans	3.0 oz / 100 lbs seed	6.6	57.5	22.8	66.3	65	21.1	5	0	3
Apron Maxx RTA	5.0 oz / 100 lbs seed	6.3	52.5	25.5	62.6	65.7	21.2	14	1	1
Apron Maxx RTA + Mertec	5.0 + 3.0 fl oz / 100 lbs seed	6.3	54.4	22.1	64.2	65.4	21.3	9	1	1
Trilex 2000	1.0 fl oz / 100 lbs seed	6.1	47.5	13.6	62.2	65.5	21.2	6	1	3
Trilex 2000 + Gaucho	1.0 + 1.6 oz / 100 lbs seed	6.6	52.5	27.1	66.4	65.6	21.5	9	1	1
Trilex 2000 + Tops 30	1.0 + 0.5 oz / 100 lbs seed	5.7	40	10.5	63.1	65.6	21.3	10	0	0
Acquire + Acronis	0.3 + 0.4 oz / 100 lbs seed	5.7	42.5	13	62.6	65.8	21.3	7	0	1
Acqire + Stamina	0.3 + 1.5 oz / 100 lbs seed	5.5	47.5	16	60.8	65.6	21	6	1	3
Maxim (4FS)	0.16 fl oz / 100 lbs seed	6.1	45	18.8	60.6	65.6	21.1	2	1	1
Allegiance F1	0.75 fl oz / 100 lbs seed	6.6	52.5	24.7	61.5	65.7	21.3	10	1	1
Apron XL	0.64 fl oz / 100 lbs seed	6	55	19.1	61	65.6	21.3	9	0	1
Apron Maxx RFC + Maxim 4FS	1.5 fl oz + 0.08 fl oz/ 100 lbs	6.2	60	27.6	62.4	65.7	21.2	13	1	0
LSD(P = 0.05)		0.7	16.3	12.18	NS	NS	NS			
CV		8.2	22.27	41.87	6.3	0.8	1.4			

Treatment Name	Product/AI Rate	Carrington 2009								
		Plant Stand	Root Rot	Root Rot Severity (% root infection)	Yield	Test Weight	Seed Protein	Root Rot Pathogens / treatment		
		plants ft^{-2}	Incidence		(bu/A)	lb/bu	%	*Fusarium* spp.	*Rhizoctonia* spp.	Unknown
Nontreated	NA	6.2	77.5	32.4	31.1	63.8	19.9	13	0	2
Cruiser Maxx Beans	3.0 oz / 100 lbs seed	6.3	62.5	22.4	53.9	64.2	18.9	10	0	0
Apron Maxx RTA	5.0 oz / 100 lbs seed	5.9	50	17.3	40	64.4	19.2	12	0	0
Apron Maxx RTA + Mertec	5.0 + 3.0 fl oz / 100 lbs seed	6.1	50	22.9	38.2	63.2	18.9	3	0	0
Trilex 2000	1.0 fl oz / 100 lbs seed	5.7	55	19.9	41.2	64	19.1	4	0	0
Trilex 2000 + Gaucho	1.0 + 1.6 oz / 100 lbs seed	6.6	55	18	64.3	64.1	19.4	4	0	1
Trilex 2000 + Tops 30	1.0 + 0.5 oz / 100 lbs seed	6.2	50	18.3	36.5	63.7	19.4	4	0	0
Acquire + Acronis	0.3 + 0.4 oz / 100 lbs seed	6.3	42.5	16.8	34.8	63.9	19	1	0	0
Acqire + Stamina	0.3 + 1.5 oz / 100 lbs seed	6.5	35	9.4	37	63.9	19	5	0	2
Maxim (4FS)	0.16 fl oz / 100 lbs seed	5.3	57.5	27.4	38.3	64.1	19.4	5	0	0
Allegiance F1	0.75 fl oz / 100 lbs seed	6.3	55	21	41.8	63	19.3	2	0	0
Apron XL	0.64 fl oz / 100 lbs seed	5.8	55	16	36.7	63.4	19.1	6	0	0
Apron Maxx RFC + Maxim 4FS	1.5 fl oz + 0.08 fl oz/ 100 lbs	6.5	50	11.7	37.6	63.8	19.2	6	0	0
LSD(P = 0.05)		NS	16.63	10.85	7.7	NS	0.8			
CV		11.2	21.73	39.46	13.5	1.1	2.8			

Conclusions

- ✓ Yield increases in yield in two of four trials indicate that seed treatments may be an economically viable option for management of root rot.
- ✓ Several *Fusarium* species and *Rhizoctonia solani* contributed to root rots in all trials.
- ✓ Emphasis should be place on evaluating the efficacy of seed treatments effective against *Fusarium* species.
- ✓ Insecticide seed treatments should be evaluated.