POLYMERS SEED COATING EFFECT WINTER CANOLA SEEDLING ESTABLISHMENT

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ABSTRACT

One of the major constraints of winter canola (*Brassica napus* L.) production in southeastern regions of US is poor stand establishment. Improvement in stand establishment with polymer coated of seeds in some crops including spring type canola has been reported but in winter type canola seed it has not been evaluated. Therefore, effect of three polymers [CelGard (CP), Spectrum 511 (SP), and DiscoClear (DC)] each at three concentrations (0.33%, 0.66%, and 0.99%), with and without fungicide Helix, and Apron on seed of two winter cultivars (cvs.) 'Abilene' and 'Jetton' at 0.75″ and 1.5″ planting depth in three soil types (Clay, Silt, and Sandy loam) were evaluated. Results showed that polymer CelGard in cv. Abilene and DiscoClear in cv. Jetton gave highest seedling establishment in all the three soils type. Seeds of both the cultivars when centricoated with Helix, gave higher seedling establishment (88.0% in cv. Abilene and 85.0% in cv. Jetton) than other polymer treatments without Helix. The seedling establishment was higher when coated seeds were planted at 0.75″ depth than 1.5″. This study suggested that polymer coated canola seeds increased the seedling establishment in all the soil types and it was further enhanced when seeds were coated with polymer and fungicide together.

Introduction

Canola is second most important source of vegetable oil, its seed contains about 40% oil and its meal has less than 30 µmol of aliphatic glucosinolates per gram (Raymer, 2002). In 2005-06 total canola production in US was 0.681 m tones (> 90% from North Dakota and Minnesota) which do not meet domestic consumption and the country has to import about 0.345 m tones mainly from Canada. The import of canola oil can be reduced or avoided by growing winter canola in the southeastern USA (Bishnoi et al., 2007) and it can be double-cropped with summer crops (Kumar et al., 2005). The major limitations of canola production is its poor field stand establishment possibly due to small seed size, planting depth, soil moisture stress, soil crusting, diseases, and pathogen in the soil. Coating seed with polymers, fungicide/insecticides may prevent stand failures and may enhance seedling establishment. Polymer seed coating improve physical properties of the seed, reduce pesticide dusts, and provide protection from the biological enemies of the seed (Bennett et al., 1992). Polymer coatings used in early fall seeded herbicide resistant canola increased the plant density by 80% as compare to uncoated seeds in Alberta, Canada (Harker et al., 2004). Such beneficial effects of polymer coating of winter canola seed with or without fungicides for the southeastern USA have not been explored.

Objectives

To determine the effect of 1) Polymers alone 2) Polymer and fungicides/pesticides seed coating on canola seedling establishment when planted at different depths in three soil types.

Materials and Methods

Seeds of two canola cultivars coated with polymers alone or with fungicides were tested for seedling establishment in three soil types: Wayensboro clay loam, Decatur silt loam, and Hartsells fine sandy loam soil. Uniformly sieve sized canola (cv. Abilene and Jetton) seeds were coated with three polymers: (CelGard, Spectrum 511, and DiscoClear) each at three concentrations (0.33%, 0.66%, and 0.99%) alone, with Helix (insecticide and fungicide), and with Apron (fungicide) and compared with uncoated seed (control). Polymers were applied with a centricoater machine (CimbriaHeid, Stockerau, Australia) and were air dried on aluminum foil. These coated canola seeds were planted at two (0.75″, and 1.5″) depths in trays containing clay loam, silt loam, and sandy loam soils, in split-split-split plot design in which treatments are randomized as a factorial RCB design with four replications of 100 seeds each. Planted seeds were firmly pressed, sprinkled with water and then placed in field environment. The seedlings with one true and two cotyledonary leaves were considered as an established seedling, were counted and expressed as percentage of seed planted.

Statistical Analysis: The main factors were statistically analyzed using an analysis of variance (ANOVA) procedure for split-split-split plot design (Gomez and Gomez, 1984),but the variation was high due to soil x treatment (21.5%), followed by cultivar x treatment (7.5%) therefore, data of each soil type was analyzed separately and sorted by variety to draw the conclusion. Treatments were analyzed by factorial RCB Design assuming that control has the same variance as the treatments. The general linear model (PROC GLM) procedure of statistical analysis system (SAS Inst., 2003) was used for comparing means by Fisher's LSD test.

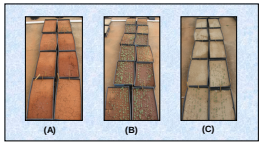
Results and Discussion

Soil: The main factor soil significantly affects the percent seedling establishment of canola seeds coated with different polymers. Clay loam soil gave the highest percent seedling establishment (Fig. 1) among three soils.

Table.1 ANOVA showing significance of all the factors sorted by cultivar in three soil types.

Source	df	Seedling Establishment (%)					
		Clay loam		Silt loam		Sandy loam	
		Abilene	Jetton	Abilene	Jetton	Abilene	Jetton
Replication	3	ns	ns	ns	ns	ns	ns
Depth (D)	1	*	*	*	*	*	*
Ea	3	ns	ns	ns	ns	ns	ns
Treatments (T)	26	**	**	**	**	**	**
Polymer	2	**	**	**	**	**	**
Concentration (C)	2	**	**	**	**	**	**
C*P	4	**	**	**	**	**	**
Pesticide (Pt)	2	**	**	**	**	**	**
Pt*P	2	**	**	**	**	**	**
Pt*C	2	**	**	**	**	**	**
Pt*P*C	8	**	**	**	**	**	**
T*D	26	**	**	**	**	**	**
Error	156	ns	ns	ns	ns	ns	ns

ns =non-significant; * =significant; ** = highly Significant



Pic.1. Polymer coated seeds of canola planted in Clay (A), Silt (B), and Sandy (C) loam soil.

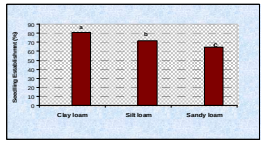


Fig. 1 Canola seedling establishment in three soil types.

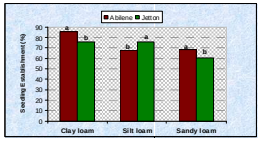


Fig. 2. Seedling establishment (%) among two canola cultivars.

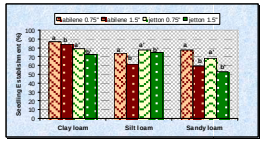
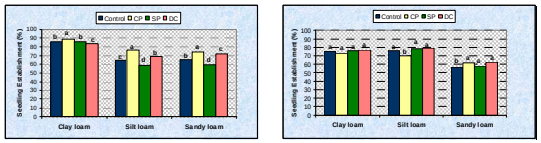


Fig. 3. Canola seedling establishment (%) in two cvs. at two planting depths.

Cultivar: Sub factors cultivar, depth, treatments, and their interaction is highly significant. Within the soil type cv. Abilene gave high percent seedling establishment in clay and sandy loam, and Jetton in silt loam soil (Fig. 2).

Depth: Seedling establishment differ significantly with depth of planting in all three soil types (Table 1), 0.75" depth of planting gave significantly high seedling establishment than 1.5" in both canola cultivars and in all the three soil types (Fig. 3). According to Berglund and McKey (2002) optimum depth of planting in canola is from 0.5″ to 1.0″.The interaction effect of Treatment × depth (p= 0.01) was significant (Table 1) there was about 10-15% variation in each soil type.

Treatments: Polymers, concentrations, and pesticides alone and their interactions significantly (p = 0.01) affected the seedling establishment in both the canola cultivars when planted in three soil types (Table 1).



(A) (B)

Fig.4. Canola seedling establishment (%) with different polymer coatings in cultivar (A) Abilene (B) Jetton.

Polymer coatings: Seed coated with polymers significantly improved the canola seedling establishment in all the three soil types.

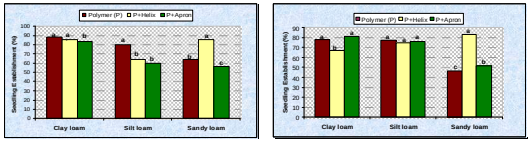
- CelGard gave significantly higher seedling establishment than control and other polymers in both the cultivars except in Jetton when planted in silt loam soil, where spectrum 511 out performed the control as well as all other polymers.
- DiscoClear gave higher seedling establishment than control and it was at par with CelGard except in cultivar Abilene when planted in silt loam and clay loam soils (Fig. 4).

Table 2. Effect of three polymer concentrations on seedling establishment (%) in two canola cultivars in three soil types.

Polymer	Concentration (%)	Seedling Establishment (%)					
		Clay loam		Silt loam		Sandy Loam	
		Abilene	Jetton	Abilene	Jetton	Abilene	Jetton
CelGard	0.33	90.9a	75.8a	77.2a	74.9a	73.5a	59.5a
	0.66	89.4a	78.6a	76.5a	68.4a	73.2a	60.9a
	0.99	85.7b	66.2b	74.9a	67.7a	75.9a	63.7a
Spectrum 511	0.33	84.3a	82.1a	61.9a	80.2a	56.5ab	58.4a
	0.66	80.3a	76.6a	59.6ab	75.6a	54.9b	58.9a
	0.99	84.5a	69.7b	54.9b	80.8a	67.0a	56.4a
DiscoClear	0.33	85.3a	73.7a	72.3a	79.6a	59.9c	60.9a
	0.66	84.3a	77.6a	60.8b	79.7a	72.5b	61.0a
	0.99	86.7a	79.5a	72.9a	78.6a	82.0a	66.4a

Polymer concentrations: Polymer concentrations significantly affected canola percent seedling establishment (Table 1). However, the variation due to polymer concentrations was very low (5%).

- CelGard gave high seedling establishment at 0.99% concentration in sandy loam and silt loam soil, whereas low concentration (0.33%) gave high seedling establishment in clay loam soil (Table 2).
- In all the concentrations Spectrum 511 performed statistically equal with exceptions of 0.66% and 0.99% in cv. Abilene when planted in sandy loam and silt loam soil. In Jetton when planted in clay loam soil 0.33% concentration of this polymer gave high seedling establishment in all treatment combinations (Table 2).
- DiscoClear at all the concentrations performed statistically equal with exceptions of 0.66% in cv. Abilene when planted in sandy loam and silt loam soil. 0.99% concentration gave high seedling establishment in all the treatment combinations except Jetton in silt loam soil (Table 2).



(A) (B)

Fig.5. Canola seedling establishment (%) with different pesticide coatings in cultivar (A) Abilene (B) Jetton

Pesticides: They significantly influenced the seedling establishment of canola. Helix gave significantly high seedling establishment in both the canola cvs. when planted in sandy loam soil, and in Jetton when plated in silt loam soil. Apron also improved seedling establishment in cv. Jetton when planted in silt loam and clay loam soil. Staff (2002) reported that polymer seed coating with fungicide reduced seed infection and increased stand establishment of a crop (Fig. 5).

Conclusions

- **The seedling establishment in canola was enhanced by coating the seed with CelGard and DiscoClear in different soil types.**
- **The use of helix (an insecticide/fungicide) in combination with the polymers further increased canola stand establishment.**
- **Polymer concentration 0.99% holds good in sandy loam and silt loam and 0.33% in clay loam soil.**
- **Author experienced and felt that polymer coatings provided ease in physical handling of the canola seeds.**

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