RESEARCH ARTICLE

Efficacy of fungicides against linseed powdery mildew

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Manuscript details:

Available online on
http://www.ijlsci.in

ISSN: 2320-964X (Online)
ISSN: 2320-7817 (Print)

Editor: Dr. Chavhan Arvind

Cite this article as:
Gohokar RT, Biradar VK and Banginwar AD (2016) Efficacy of fungicides against linseed powdery mildew, *Int. J. of Life Sciences*, A6:37-39.

Acknowledgment:
Authors are very much thankful to Dr. Vikash Dhomane principal of J. M. Patel College, Bhandara for providing the laboratory facility for this work.

ABSTRACT

Powdery mildew caused by *Oidium lini* is an important disease of linseed among the various diseases powdery mildew disease has been identified has one of the serious problem particularly in late sown crops normally in Vidarbha. Field studies were carried out at Linseed Research Farm, College of Agriculture, Nagpur, Maharashtra (India) to find out effective fungicides to manage the powdery mildew of linseed. Results indicated that Propiconazole (0.1%), Difenconazole (0.05%) and Wetable sulphur (0.25%) applied twice were highly effective for the management of disease and resulting in higher seed yield of linseed of both (9.53 q/ha) followed by wettable sulphur (8.77q/ha).

Key words: Linseed, Powdery mildew, *Oidium lini,* fungicides.

INTRODUCTION

Linseed (*Linum usitatissimum*) is an important oilseed crop grown for both seed as well fibre. In South East Asia comprising, Turkistan, Afghanistan and India, it mainly grown for oil purposes. Practically every part of linseed plant is commercially utilized either direct or after value addition. On a small scale, its seed and oil directly used for human consumption, such as flax seed breads, bagels and other baked and fried cuisine. It is basically an industrial crop and about 80 per cent of soil is utilized by paints, varnishes, coating oil, linoleum, pad and printing inks, leather and soap industries. Linseed is highly nutritious and protects from several diseases. It is source complete protein comprising all eight essential amino-acids, high order lino lenic acid (Omega-3 fatty acid) carbohydrates, vitamins and minerals. Recent medical researchers have found linseed as best herbal source of Omega-3 fatty acid Omega-6 fatty acids which have a lot of improving effect on human metabolism. Its stem provides good quality fibre which is lustrous and can be blended with wool, cotton silk, rayon and polyester well.

India is an important linseed producer which contributes about 11.82% to world acerage producing about 7% of world production. the major linseed growing area lies in MP, Chhattisgarh, Uttar Pradesh, Maharashtra, Bihar, Orissa, Jharkhand, Karnataka and Assam which together account for more than 95% of the total area. in India linseed predominantly grown on marginal and rain fed soils (63%) and *utera* (25%). The prime reason productivity of

crop is that major linseed producing area under cultivation lies under, sub marginal, un irrigated input starved and poor management condition in states referred to above. However, the remarkable increase in productivity of Rajasthan (1066 kg ha^{-1}), Bihar (865 kg ha^{-1}) and Nagaland (807 kg ha^{-1}) is almost surpassing the productivity of Asia (524 kg ha^{-1}).

Among the various diseases, powdery mildew *Oidium lini* has been identified as one of the serious problem particularly in late sown crops normally in Vidharbha. The disease appears after mid of January at the time of capsule formation or seed setting; the powdery growth was observed on entire plant. The capsules were also covered with powdery mass therefore, the investigation was undertaken to study the efficacy of fungicides against the disease.

MATERIALS AND METHODS

Field trials were conducted at Linseed Research Farm, College of Agriculture, Nagpur, Maharashtra (India) using Randomized Block Design with seven treatments with three replications during 2009 to 2012. The first spray of fungicides was given immediately after appearance of powdery mildew and the second spray was given after 15 days interval. Disease intensity was evaluated by using 0-5 scale (Mayee and Datar, 1986) and data was statistically analyzed. The incremental cost benefit ratio (ICBR) was calculated by taking the total yield per ha. The gain in yield as compared to the untreated check to the fungicidal treatments was calculated by taking seed yield *vis-a-vis* amount spent (according o the prevailing market rates of the chemical, labours and selling price of linseed).

RESULTS AND DISCUSSION

Among several methods for management of Linseed powdery mildew, use of fungicides is important especially in the absence of resistant varieties. The application of fungicides reduces the incoming inoculums and its spared on the surface of the host plant .in absence of foliar sprays, the inoculums would have infected most of the foliage and such infected plants yielded less due to damage of photosynthetic area and pathogens ability to reduce the photosynthetic rate due to its biotrophic nature of infection. In present studies, application of systemic propiconazole (0.1%) recorded minimum disease

Table 1: Chemical control of Powdery mildew of Linseed (Pooled Results)

Sr. No.	Treatments	Powdery mildew PDI (%)				Yield (kg/ha)			ICBR	Net Returns (Rs.ha^{-1})
		2009-10	2010-11	2011-12	Pooled mean	2009-10	2010-11	2011-12	Pooled mean	
1.	Propiconazole (0.1%)	6.02 (14.22)	11.46 (19.59)	15.71 (23.27)	11.06 I(19.11)	1137	852	870	953	8.70	11380
2.	Difenconazole (0.05%)	8.60 (17.00)	12.93 (21.02)	17.49 (24.30)	13.01 (20.94)	1317	769	773	953	7.20	11380
3.	Mancozeb (0.25%)	38.60 (35.31)	20.23 (26.67)	65.35 (54.02)	41.39 (39.68)	953	561	579	698	3.53	2503
4.	Hexaconazole (0.1%)	25.57 (30.32)	33.53 (35.37)	17.54 (24.64)	25.55 (30.16)	1073	524	540	712	2.6	2750
5.	Quintal (0.1%)	32.03 (34.45)	10.03 (18.42)	37.63 (37.77)	26.56 (30.25)	903	763	782	816	4.87	6432
6.	Chlorothalonil (0.2%)	53.07 (46.76)	14.66 (22.08)	57.17 (49.13)	41.63 (39.45)	886	743	786	805	2.98	5494
7.	Wettable sulphur (0.25%)	17.03 (24.39)	25.70 (30.38)	22.51 (27.69)	21.75 (27.71)	990	814	827	877	24.70	9478
8.	Control	66.3 (54.73)	68.53 (56.18)	69.31 (56.41)	68.05 (55.56)	787	518	532	612		--
	S.E. (m) ±	1.60	2.37	2.59	4.57	140	106.38	10.82	57.14		
	C.D. at 5%	4.84	7.18	7.93	14.00	430	N.S.	N.S.	174.99		

Figures in parenthesis indicates arcsine transformed values.

intensity of powdery mildew (20.93%) which was followed by Difenconazole (0.05%) Wettable sulphur (0.25%) Quintal (Iprodione + Carbendazim) (0.1%) and hexaconazole (0.1) remain statistically at par with each other significantly superior over mancozeb (0.25%), Chlorothalonil (0.2%) Gupta and Shyam (1998) in reducing intensity of disease. All the fungicides recorded significantly superior over no spray check. Efficacy of foliar sprays of propiconazole, difenconazole and hexaconazole has also been reported earlier by Amaresh *et al.,* (2013). The present study is also in conformity with Basandrai *et al.,* (2013).

Similarly, all the fungicidal treatments resulted in higher seed yield as compared with unsprayed check. Propiconazole and Difenconazole recorded higher yield *i.e.* 9.53 q ha^{-1} each followed by wettable sulphur 8.77q ha^{-1}. The seed yield of these treatments was at par and significantly superior over no spray and rest of the treatments.

The economics of fungicidal application based on two sprays was assessed. Results revealed that the ICBR with Wettable sulphur was 24.70. It was highest due to low cost of sulphur as compared to costlier fungicides *viz.,* Propiconazole 8.70 Difenconazole 7.20, Hexaconazole 3.50 and Quintal 4.87; respectively. The net returns gained with foliar sprays of Propiconazole (0.1%) and Difenconazole was Rs.11380 each and wettable sulphur (0.25%) was Rs. 9478 ha^{-1}, respectively.

It is evident from the present studies that fungicides that Propiconazole (0.1%), Difenconazole (0.05%) and Wetable sulphure (0.25%) applied twice were highly effective for the management of powdery mildew and obtaining higher monetary returns.

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