International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(3): 53-56

Received: 26-03-2020
Accepted: 28-04-2020

Bhagyashree Singh
Sai Nath University, Ranchi, Jharkhand, India

RB Singh
N.D. University of Agriculture and Technology Kumarganj, Faizabad, Uttar Pradesh, India

Prashant Kumar Singh
ITM University, Gwalior, Madhya Pradesh, India

Corresponding Author:
Bhagyashree Singh
Sai Nath University, Ranchi, Jharkhand, India

Study on the resistance inducing chemicals against the Alternaria blight disease in linseed in *in vivo*

Bhagyashree Singh, RB Singh and Prashant Kumar Singh

DOI: https://doi.org/10.22271/chemi.2020.v8.i3a.9465

Abstract
Linseed is one of the major *Rabi* oilseed crop of India. It is grown in Madhya Pradesh, Uttar Pradesh, Maharashtra, Jharkhand, Chhattisgarh and Bihar. In the country Madhya Pradesh and Uttar Pradesh together contribute to the national linseed production to the extent of about 70%. It is one of the oldest crops cultivated for seed and fiber. Among the various factors responsible for lowering down its yield Alternaria blight caused by *Alternaria lini* is considered to be the major one. The efforts were made to search efficacious and cheaper resistance inducing chemicals as compare to fungicide under field condition for the management of the disease. Field experiments were conducted at the University Experiment Station at Kumarganj (Faizabad) Uttar Pradesh during rabi 2011-12 & 2012-13 seasons following recommended agronomic practices including nutrient management i.e. 80Kg N, 40Kg P, 40Kg/ha. The cultivar 'Shekhar' was sown on 25 October in randomized block design having 4m x 3m plot size with 30x10 cm plant spacing in three replications. The effectiveness of different resistance inducing chemicals viz. Benzoic acid, Napthelic acetic acid, Salicylic acid, Phosphoric acid, Isnicotinic acid at 0.05 and 0.1% concentration along with fungicide Mancozeb @ 0.25% were tested against the disease severity and seed yield of the crop Minimum disease (28.40%) severity with maximum yield T_{10} (724.16kg/ha) was recorded with spraying of Salicylic acid @ 0.10% followed by the same chemical @0.05% and Benzoic acid @ 0.10% respectively. But maximum benefit cost ratio was recorded with Benzoic acid @ 0.05%.

Keywords: *In vivo*, chemicals, *Alternaria lini*, Percent disease intensity, Linseed

Introduction
Linseed (*Linum usitatissimum* L.) is a multipurpose crop and is grown in India mainly for oil, whereas in western countries, it is grown especially for fiber. There are different varieties of linseed meant for both purposes. This crop has many industrial and medicinal values in addition to its direct food value. Linseed (*Linum usitatissimum* L.) (2n = 30) belongs to the family Linaceae and the genus *Linum*, which has 100 species. *Linum usitatissimum* Linn is commercially the most important one. It is commonly known as "Ulsee" or "Tisee". Globally linseed is an important crop and its production is 21.23 lac tones from 21.12 lac/ ha with an average yield of 1006 kg/ha. While our national production is 1.54 lac tonnes from an area of 3.42 lac ha with poor productivity of 449 kg/ha. India ranks second in area after Canada in the world, but is at fourth place in term of production after Canada, China and U.S.A. In term of productivity India (449kg/ha) is far below to Canada (1492kg/ha), U.S.A (1484kg/ha), Egypt (1465kg/ha), Russia (1292kg/ha) and China (944kg/ha) (Anonymous-2011). The efforts were made to search efficacious and cheaper resistance inducing chemicals as compare to fungicide under field condition for the management of the disease.

Materials and methods
Field experiments were conducted at the University Experiment Station at Kumarganj (26º47'N, 82º12'E, 113 m mean sea level), Faizabad, Uttar Pradesh during rabi 2011-12 & 2012-13 seasons following recommended agronomic practices including nutrient management i.e. 80Kg N, 40Kg P, 40Kg/ha. The cultivar 'Shekhar' was sown on 25 October in randomized block design having 4m x 3m plot size with 30x10 cm plant spacing in three replications.

The effectiveness of different resistance inducing chemicals viz. Benzoic acid, Napthelic acetic acid, Salicylic acid, Phosphoric acid, Isonicotinic acid at 0.05 and 0.1% concentration along with fungicide Mancozeb @ 0.25%were tested against the disease severity and seed yield of the crop. Spraying of chemicals was initiated after 30 days of sowing as prophylactic spray. Second spray was given at disease initiation .The required amount of each chemicals were first dissolved in few ml of ethanol and then mixed with requisite amount of water and sprayed with knap-sap sprayer of 10 liter capacity. The crop was regularly observed for first appearance of disease. The disease severity in each treatment was recorded 10 days after first spraying and at prematurity stage using 0-5 point scale (0 = Disease free; 1 = Up to 10 % leaf area infected; 2 = > 10.1% to 25% leaf area infected; 3 = >25.1% to 50% leaf area infected; 4 = >50.1% to 75% leaf area infected; and 5= >75% leaf area infected and the per cent disease intensity (PDI) was calculated as per formula (Eq. 1) given below:

$$PDI = \frac{\text{Sum of total numerical rating}}{\text{Total number of leaves examined}} \times \frac{100}{\text{maximum-grade}}$$

Seed yield/ plot were recorded in each treatment separately to see the difference in yield between treated and control condition and yield/hectare was calculated. Test weight of seed of each treatment was recorded as g/1000 seeds. The benefit of cost ratio was calculated on the basis of seed yield of each treatment.

Result and Discussion

A perusal of the table 1.1 indicates that all the treatment significantly reduced the severity of disease on leaves as compared to untreated check. Minimum disease intensity of 29.06% and 37.47% were recorded with Salicylic acid (0.10%) followed by lower concentration of same chemicals 0.05% (30.98 and 38.54%) and Benzoic acid 0.10% (33.21 and 41.73%) respectively during both the years but all were at par. The treatment Benzoic acid (T_2) was also found statistically of par with treatment T_3 (NAA 0.05%), T_4 (NAA 0.10%),T_9 (Isonicotoic acid 0.05%) and T_{11} (Mancozeb @ 0.25%) during 2011-2012 and with T_3,T_4,T_7,T_8,T_9,T_{10} during 2012-13 respectively. In case of bud damage all the treatment were recorded significantly effective over control (untreated check) during 2011-12, when disease pressure was low but during 2012-13 only treatment T_5 (Salicylic acid 0.05%) and T_3 (NAA 0.05%) showed significant superiority is controlling the bud damage over check. Minimum bud damage during both the years were recorded with treatment T_5 i.e. spray of Salicylic acid @0.05%, it was followed by the treatment T_4 (NAA 0.10%) and T_3 (NAA 0.05%) during 2011-2012 and treatment T_3 and T_2 during 2012-13 respectively. Maximum disease severity (PDI 44.54 and 56.29) and bud damage (29.33 and 39.22%) were recorded in untreated plots during both the years. All the treatment significantly increased the seed yield as compared with untreated check except treatment T_8 (Phosphoric acid @0.10%) and T_9 (Isonicotonic acid @0.05%) Maximum yield of 749.99 kg/ha and 783.33 kg/ha was recorded with spraying of Salicylic acid @0.10% during both years. It was followed by the treatment T_2 (Sprays of Benzoic acid @0.10%) and T_1 (Sprays of Benzoic acid @ 0.05%) during first year and treatment T_{10} (Sprays of Isonicotonic acid @0.10%) and T_2 during second year respectively. All there treatment were found statistically at par among themselves. Minimum yield (474.99 and 408.33 kg/ha) was recorded in check plots. On mean basis of both the years. Maximum seed yield was recorded by T_{10} (724.16 kg/ha) and T_2 (719.22 kg/ha) respectively. Maximum test weight (1000 seed weight) was recorded with treatment) T_1 (0.05%of Benzoic acid) during both the years. It was followed by treatments T_{10} first year while during second years no significant difference was noted among the treatments and check.

Yield loss with different treatments on mean basis was avoided from 19.61 to 42.35 maximum being with spraying of Salicylic acid (0.10%). It was again followed by treatment T_{10} (38.98) and T_2 (38.56%) respectively. Test weight loss was also avoided by the treatment from 1.34 (T_5) to 10.15 Per cent (T_1).

Maximum net return of Rs 8168.34/ha with benefit cost ratio of 5.60 was recorded with T_2 (Benzoic acid 0.10%) followed by treatment T_6 (salicylic 0.10%) but maximum benefit was recorded with lower doses of Benzoic acid (7.10) and Salicylic acid (4.8) respectively.

Table 1: Effectiveness of resistance inducing chemicals against severity of Alternaria blight disease in linseed CV Shekhar during 2011-2012 and 2012-2013

Treatments	Seed yield (kg/ha)				Test weight(g)			
	2011-2012	2012-2013	mean	Avoidable loss %	2011-2012	2012-2013	mean	Avoidable loss%
T_1 Benzoic acid 0.05%	716.66	666.66	691.66	36.10	9.03	8.90	5.96	10.15
T_2 Benzoic acid0.10%	743.99	694.44	719.22	38.56	8.33	8.33ss	8.30	3.01
T_3 NAA 0.05%	641.66	624.99	633.33	30.22	8.50	8.10	8.25	2.42
T_4 NAA 0.10%	699.99	658.33	679.16	34.93	8.50	8.40	8.45	4.73
T_5 Salicylic acid 0.05%	678.32	649.99	664.16	33.46	8.13	8.20	8.16	1.34
T_6 Salicylic acid 0.10%	749.99	783.33	766.66	42.35	8.40	8.10	8.25	2.42
T_7 Phosphoric acid 0.05%	699.99	641.66	670.82	34.12	8.77	8.40	8.60	6.39
T_8 Phosphoric acid 0.10%	599.99	508.33	554.16	20.26	8.93	8.50	8.70	7.47
T_9Isonicotonicacid 0.05%	583.33	516.06	549.69	19.61	8.67	8.40	8.50	5.20
T_{10} Isonicotonicacid 0.10	698.33	749.99	742.16	38.98	8.93	8.50	8.70	7.47
T_{11} mancozeb @ 0.25%	699.99	649.99	674.99	34.53	9.03	8.10	8.56	5.95
T_{12} Control	474.99	408.83	441.91	-	7.90	8.20	8.05	-
GM	498.88	682.82	-	-	8.58	8.34	-	-
Sem+	59.99	45.83	-	-	0.278	0.311	-	-
CD at 5%	165.83	143.32	-	-	0.815	0.911	-	-

Table 2: Effect of chemicals on seed yield and test weight of linseed CV Shekhar during 2011-2012 and 2012-2013

Treatments	2011-2012 Severity of disease on leaves (PDI)		Bud damage (%)	2012-2013 Severity of disease on leaves (PDI)		Bud damage (%)
	After I st spray	After II nd spray		After I st spray	After II nd spray	
T_1 Benzoic acid 0.05%	13.27(21.30)	31.27(34.27)	27.00(31.23)	15.80(23.42)	45.87(42.53	30.33(33.13)
T_2-Benzoic acid 0.10%	14.20(22.06)	30.00(33.21)	24.67(29.75)	16.00(23.58)	44.53(41.73)	28.33(32.08)
T_3-NAA 0.05%	15.47(23.34)	33.67(33.49)	29.67(32.97)	17.60(24.88)	46.40(42.94)	25.33 (30.15)
T_4-NAA 0.10%	17.80 (24.95)	33.67 (33.49)	24.33 (29.50)	20.60 (27.06)	46.93 (42.88)	30.00 (33.16)
T_5-Salicylic acid 0.05%	15.80 (23.42)	26.53 (30.98)	22.67 (28.40)	13.80 (21.81)	39.53(38.54)	20.00(26.07)
T_6-Salicylic acid 0.10%	11.40(19.73)	23.60(29.06)	31.67(34.20)	12.07(20.27)	37.07(37.47)	30.33(33.38)
T_7-phosphoric acid 0.05%	21.10(27.28)	37.60(37.88)	35.00(36.26)	21.60(27.76)	54.67(47.67)	36.66(37.15)
T_8-Phosphoric acid 0.10%	22.40(28.25)	36.80(37.85)	35.00(36.23)	21.23(27.42)	50.03(45.00)	28.00(31.64)
T_9-Isonictonic acid 0.05%	17.67(24.80)	37.87(37.58)	35.00(36.27)	22.30(28.18)	53.93(45.52)	30.33(33.29)
T_{10}-Isonictonic acid 0.10%	21.67(27.76)	31.60(34.58)	29.67(32.95)	19.87(26.42)	40.33(33.35)	20.33(32.09)
T_{11}-Mancozeb @0.25%	20.73(26.78)	37.20(37.58)	29.87(33.03)	21.20(27.42)	48.80(44.31)	31.00(33.35)
T_{12}-Control	22.60(28.38)	49.27(33.35)	40.33(33.35)	24.00(29.33)	69.20(56.29)	40.00(39.22)
Gm	17.84(24.88)	34.26(35.62)	32.62	18.83(25.70)	48.16(43.91)	32.90
SEm+	1.62	1.51	0.902	1.80	1.73	3.020
CD at 5%	4.78	4.47	2.646	5.33	5.13	8.58

Table 3: Economics of the chemical treatments for the management of Alternaria blight in linseed during 2011-2012

Treatments	Additional yield over control (kg/ha)	Additional income (Rs/ha)	Cost of protection (Rs/ha)	Net return (Rs/ha)	Benefit cost ratio
T_1 Benzoic acid 0.05%	241.67	8458.45	1043.33	7415.12	7.10
T_2 Benzoic acid 0.10%	275.00	9625.00	1456.66	8168.34	5.60
T_3 NAA 0.05%	166.67	5833.45	7296.00	-1462.55	-0.20
T_4 NAA 0.10%	225.00	7875.00	13963.00	-6088.00	-0.40
T_5 Salicylic acid 0.05%	203.33	7105.00	1225.00	5880.00	4.8
T_6 Salicylic acid 0.10%	275.00	9625.00	1820.00	7805.00	4.29
T_7 Phosphoric acid 0.05%	225.00	7875.00	1270.00	6605.00	5.2
T_8 Phosphoric acid 0.10%	125.00	4375.00	1910.00	2465.00	1.29
T_9 Isonicotoic acid 0.05%	108.34	3791.90	4413.00	-621.1	-0.14
T_{10} Isonicotoic acid 0.10%	183.34	6416.90	8196.00	1774.1	-0.22
T_{11} Mancozeb@0.25%	225.00	7875.00	2230.00	5645.00	2.53

Discussion

The efforts have been made to find out the effectiveness of resistance inducing chemicals for the management of Alternaria blight disease of linseed crop in sick plot. A perusal of the table indicates that all the treatment significantly reduced the severity of disease on leaves as compared to untreated check. Minimum disease intensity of 29.06% and 37.47% were recorded with Salicylic acid (0.10%) followed by lower concentration of same chemical 0.05% (30.98 and 38.54%) and Benzoic acid 0.10% (33.21 and 41.73%) respectively during both the years but all were at par. In case of bud damage all the treatments were recorded significantly effective over control (untreated check) during 2011-12, when disease pressure was low but during 2012-13 only treatment T5 (Salicylic acid 0.05%) and T_3 (NAA 0.05%) showed significant superiority in controlling the bud damage over check. Maximum test weight (1000 seed weight was recorded with treatment) T_1 (0.05% of benzoic acid) during both the years. It was followed by treatments T_{10} during second years no significant difference was noted among the treatments and check) Maximum net return of Rs 8168.34/ha with benefit cost ratio of 5.60 was recorded followed by treatment T_6 (salicylic 0.10%) but maximum benefit was recorded with lower doses of Benzoic acid (7.10) and salicylic acid (4.8). Concurrent with present finding, Singh and Singh reported maximum effective NAA followed by Salicylic acid against *Alternaria* blight of linseed. Singh (2007) [4] reported the management of Alternaria blight in linseed with plant growth activator namely salicylic, BION (CGA 245704) and Phosphoric acid and fungicide Indofil M-45. It showed phytotoxic effect. Prophylatic sprays (30 and 45 DAS after planting) of Salicylic acid were superior over spray after disease appearance. Singh *et al.* (2004) [2] also reported the affectivity of salicylic acid against *Alternaria brassicae* causing blight disease mustard, while Singh and Singh reported maximum effective NAA followed by Salicylic acid against *Alternaria* blight of linseed. Sunjula *et al.* (2010) have reported effectiveness of Salicylic acid with combination of benzothiadiazole in defense mechanism by increasing peroxidase activity and Phenolic content in the host against the *Alternaria brassicae.*

Conclusion

In both year (2011- 12 & 2012-13) Maximum reduction in disease severity with increased yield was recorded with the two sprays of Salicylic acid @ 0.10 % followed by 0.05 % concentration of same chemicals and Benzoic acid 0.10 per cent., respectively, but all were at par, whereas maximum benefit cost ratio was recorded with spraying of Benzoic acid (0.05% and 0.10%).

Acknowledgement

The authors thank the Department of Plant Pathology of College of Agriculture NDUAT Faizabad (U.P.) for providing the necessary facilities.

Reference

1. Anonymous. Annual Report: 2010-11, Linseed P.C unit (Linseed) C.S.A.U.A & T Kanpur, 2011, 272.
2. Singh R.B, Singh R.N. Occurrence and management of Alternaria blight of linseed in eastern *India Pl Dis Res.* 2004; 19:120-124.

3. Singh R.B, Singh H.K. Evaluation of resistance inducing chemicals against Alternaria Blight of Linseed *Indian Phytopath.* 2006; 59(3):366-367.
4. Singh R.B, Singh R.N. Integrated management of blight of linseed caused by *Alternaria* spp *Indian J Agric Sci.* 2007; **77**(1):55-58.