

MANAGEMENT OF VASCULAR WILT OF LENTIL THROUGH OILS

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ABSTRACT

Field experiments were carried out in N. E. Borlaug Crop Research Center of G. B. Pant University of Agriculture and Technology, Pantnagar during Rabi season 2007-08 and 2008-09 crop season. It has been observed that seed treatment with menthol oil (50ml/kg seed) showed significant response with respect to disease incidence (0.56% and 1.32%), 1000-grain weight (13.73g and 13.67g) and grain yield (603.10 and 503.50) kg/ha followed by geranium oil (50 ml/kg seed) showed disease incidence (0.82% and 1.51%), 1000 grain weight (13.38 g and 13.03g), grain yield (584.50 and 475.20) Kg/ha and citronella oil (50ml/kg seed) resulted disease incidence (1.03% and 2.15%), 1000 grain weight (12.53g and 12.50g), grain yield (517.30 and 465.00) kg/ha while Jatropa oil (50ml/kg seed) showed high disease incidence (1.42% and 3.42%), 1000 grain weight (11.80g and 12.03g), lowest grain yield. (425.00 and 392.70) Kg/ha during 2007-08 and 2008-09 crop season respectively. Minimum disease incidence and maximum grain yield recorded in menthol oil treated plots followed by geranium oil and citronella oil while Jatropa oil showed high disease incidence and lowest grain yield during both crop season 2007-08 and 2008-09.

INTRODUCTION

Pulse on account of their vital role in security and soil ameliorating properties have been an integral part of sustainable agriculture since age however productions of pulses in uttrakhand has drastically came down in the period India is producing which is one of the largest pulse producing country in the world however about 14.76 million tones of pulse from an area of 23.63 million hectare. 2-3 million tons of pulse is imported annually to meet the domestic consumption requirement. Thus there is need to increase production and productivity of pulse in the country by more intensive intervention. In Indian agriculture, pulses are very important, most of Indian population is vegetarian and derive their dietary protein from pulses. India is one of the major pulse growing country in the world, due to deep penetrating root system, it utilize the limited available moisture more efficiently than other crops and has ability to fix atmospheric nitrogen in symbiotic association with *Rhizobium* spp. (Anonymous, 2006). The area, production and productivity of pulses in India during 2007-08 was 23.86 million hectare area, 15.21 million tones production and 638 kg/ha productivity, respectively (Anonymous, 2008). Lentil is one of the oldest crops that originated in near east and mediterranean region. It was known to ancient in Egypt and Greece. It had spread to Europe, India and China and now it is introduced and cultivated in most subtropical and warm temperate region. Lentils remain stable in Middle Eastern and Indian diets, and one popular in the cuisines throughout the world (Anonymous, FAQ, 2013). If you really want healthy hairs and scalp, then include lentil in your diet at least 3-4 times a week lentil are rich in folic acid (Anonymous, TOI, 2013). The total area under lentil in India is 1.59 m ha with a total production 0.94 m t and 591 Kg/ha productivity

(Anonymous, 2011). The extent of the damage to the crop due to the disease ranged from 20-40% annually from 20-24% (Saxena and Johnsen 2007). Lentil wilt caused by *Fusarium oxysporum* f.sp. *Lentis* appears in the field at both seedling and adult stage. In seedling wilt sudden drooping followed by drying of leaves and the whole seedlings and apparently healthy looking roots with reduced proliferation. Adult maturity stage symptoms first appears during flowering to late pod filling stage, sudden drooping of top leaflets of the affected plant leaflet closure without premature shedding apparently healthy looking root system with a slight reduction in the lateral roots. Seed from plants affected in mid-to-late pod filling stage are shriveled dried dull in appearance (Khare *et al.*, 1979). Excessive use of agro-chemicals like fungicides may affect the soil health and lead to declining of quality of products. Hence, a natural balance needs to be maintained at all cost for existence of life and property. The obvious choice would be judicious use of agro-chemicals and more and more use of naturally occurring material in farming systems. It helps in maintaining environment health by reducing the level of pollution, human and animal health hazards, cost of agriculture production. Although various fungicides have promising results in controlling the wilt of lentil but there is a problem of phytotoxicity and fungicidal residue leading to the environmental pollution. In recent times, there has been a worldwide sowing to the use of eco-friendly methods for protecting the crops from diseases. Present paper deals with use of oils against wilt in lentil.

MATERIALS AND METHODS

The field experiment was conducted consecutively for two Rabi crop season 2007-08 and 2008-09 at Crop Research

Centre (CRC) of G.B. Pant University of Agriculture and Technology, Pantnagar. Lentil variety Sehore 74-3 was used throughout the investigation. Topographically Pantnagar is located at 29°N latitude and 79.3°E longitude at an altitude of 243.84 meter above the mean sea level in the ground and subtropical region of North West plain zone at the foothills of Shivalik range of Himalayas. The average relative humidity is highest (70-90%) in July-August and December-January and lowest (35-40%) in April-May.

Nene and Thapliyal, 1973 Preparation of cold aqueous extract fresh plant material were collected and washed first in tape water and then in distilled water. Hundred grams of fresh samples was chopped and then crushed in a surface sterilized pestle and mortar by adding 100 ml sterile water (1:1w/v) the extract was filtered through two layer of muslin cloth. Finally filtrate thus obtained was used as stock solution. To study the antifungal mechanism of plant extract.

Vincent, 1947, the poison food technique was used five and ten ml of stock solution was mixed with 95 and 90 ml of sterilized molten PDA medium, respectively so as to get 5 and 10 percent concentration. The medium was thoroughly shaken for uniform mixing of extract. twenty ml of medium was poured in to sterile petriplates, mycelium of five mm size discs from periphery of activity growing culture were cut out by sterile cork borer and one such disk was placed on the centre of each agar plate. Controls were also maintained by growing the pathogen on PDA plates. Then such plates were incubated at 27 ± 1°C temperature and radial growth was taken when maximum growth occurred in the control plates.

***In vitro* bioassay of oils**

Six different oils *viz.*, citronella oil, geranium oil, Jatropha oil, menthol oil, mustard oil, neem oil were assessed against *Fusarium oxysporum* f.sp. *lentis* with different concentration (2.5, 5.0, and 10.0%) and the percent inhibition of spore germination was calculated after 24, 48 and 72 h at 25 ± 1°C temperature.

***In vivo* studies**

Experiment was conducted in a Randomized Block Design (RBD) with three replications. The experimental plot in silty clay loam soil field preparation was begin in the second week of October. Soil was prepared by one ploughing with a soil turning plough followed by three to four harrowing and the field was leveled by tractor operated leveler. Recommended dose of nitrogen @ 20 kg/ha, phosphorus @ 60 kg/ha and potash @ 50 kg/ha was applied before sowing. Fertilizer was broadcast and mixed in the soil with the help of harrow. Seed of lentil variety Sehore-74-3 was used. The seeds were treated with oils 24 hours prior to sowing @ 50ml/Kg seed of each oil. Sowing was done on 18 November, 2007 and 21st November, 2008 respectively. The size of each plot was 3.0 × 1.5 m² sowing depth was 3-4 cm and covered with soil for proper germination. After five weeks of germination weeding and irrigation was done as required. Three hand weeding was done and one light irrigation was given during the crop season.

Observation of growth and yield component

Plant growth and yield attributes studies as per produce given

below.

Thousand grain weight - One thousand seed were counted with the help of tally counter separately from each plot and grain weight recorded in gram (g).

Grain yield per plot - Per plot yield was recorded after threshing and drying of the lentil crop in gram (g).

Grain yield per hectare - Dried lentil seed from the individual plot were harvested, air dried, and grain was threshed and cleaned. The clean seeds were dried up to 10-12% moisture by weight, per plant grain yield was recorded and net plot yield in gram was converted in to kg/ha

Disease scoring method

Different scales have been used for scoring the disease in scoring experiment per cent of dead plant has been used as a criterion for scoring test line of lentil against wilt. Observations were made at 15 days after sowing till harvest and disease incidence was calculated as per the rating scale of 1 to 4 as: 1 = 0-5 per cent wilting (resistance); 2 = 5-10% (moderately resistance); 3 = 10-30% (moderately susceptible) and 4 = 30% (susceptible) area covered by lesions (highly susceptible). (Khare *et al.*, 1976)

RESULTS AND DISCUSSION

The data recorded in the experiment is shown in the Table 1 which revealed that all the oils were found significantly superior over check by inhibiting the growth of test pathogen. Menthol oil proved the best oil which significantly gave 4.0, 2.8 and 2.2 mm radial growth at 2.5%, 5.0% and 10.0% concentration, respectively and whereas Jatropha oil gave the maximum radial growth @ 2.5% (14.7 mm), @ 5% (10.4 mm) and @ 10% (9.7 mm). Next superior oil was geranium oil which showed 5.1, 4.0 and 3.1 mm radial growth at 2.5%, 5% and 10% concentration respectively, followed by Citronella 7.7 oil mm, 7.0 mm and 6.3 mm radial growth at 2.5%, 5% and 10% concentration respectively. Six of oils on wilt incidence, 1000 grain weight and grain yield during 2007-08 and 2008-09 crop season given in Table-2. During 2007-08 crop season the data recorded revealed that menthol oil showed the lowest disease incidence (0.56%) followed by geranium oil (0.82%) and citronella oil (1.03%) while high disease incidence (1.42%) was recorded in Jatropha oil. The highest grain yield (603.1 kg/ha) was recorded in Menthol oil followed by geranium oil (584.5 kg/ha) and citronella oil (517.3 kg/ha) while Jatropha oil showed lowest grain yield (425.0 kg/ha).

Maximum 1000-grain weight (13.73) was recorded in Menthol oil recorded plot followed by geranium oil (13.38) and citronella oil (12.53g) while minimum grain weight recorded in Jatropha oil (11.80 g) in treated plots. Grain yield increased over check (72.3%) in menthol treated plot followed by geranium oil (67.0%) and citronella oil (47.80%). Jatropha oil showed minimum (21.43%) increase in grain yield over check.

During 2008-09 crop seasons, menthol oil again resulted in minimum disease incidence (1.32%) like previous years followed by geranium oil (1.51 %) and citronella oil (2.15%). While it was maximum (3.42%) in Jatropha oil. Highest grain

Table 1: Effect of different oils on radial growth of *Fusarium oxysporum* f.sp. *lentis* at different concentration

Treatment	2.5%				5.0%				10%			
	24 h	48 h	72 h	Mean	24 h	48 h	72 h	Mean	24 h	48 h	72 h	Mean
Citronella oil	5.0	5.0	13.0	7.7	4.0	6.0	11.0	7.0	4.0	6.0	9.0	6.3
Geranium oil	3.3	5.0	7.0	5.1	3.0	4.0	5.0	4.0	2.3	3.0	4.0	3.1
Jatropha oil	12.0	13.0	19.0	14.7	8.0	10.5	12.6	10.4	6.1	9.0	14.0	9.7
Menthol oil	2.0	4.0	6.0	4.0	1.3	3.0	4.0	2.8	1.3	2.3	3.0	2.2
Mustard oil	11.0	11.0	18.0	13.3	9.0	10.0	12.0	10.3	6.0	8.0	13.0	9.0
Neem oil	9.0	10.0	15.0	11.3	8.0	10.0	11.6	9.9	5.0	8.0	10.0	7.7
Check	12.0	14.0	20.0	15.3	11.0	15.1	19.0	15.3	10.0	15.0	21.0	15.3
Mean	7.8	8.9	14.0		6.2	8.2	10.7		5.0	7.3	10.6	
	SEm ±			CD (5%)	SEm ±			CD (5%)	SEm ±			CD (5%)
Interval (A)	0.21			0.61	0.22			0.65	0.20			0.59
Botanicals (B)	0.32			0.93	0.34			0.99	0.31			0.90
A × B	0.56			1.62	0.60			1.72	0.54			1.56

Table 2: Effect of oils on wilt incidence, grain yield, 1000 grain weight during 2007-08 and 2008-09 crop seasons

Treatment	Dose ml/kg seed	Disease incidence (%)		Disease decline (%)		Grain yield (kg/ha)		1000 grain weight		% increase over check	
		2007-08	2008-09	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09
Citronella oil	50	1.03 (5.79)	2.15 (8.41)	93.98	87.94	517.30	465.00	12.53	12.50	47.80	24.00
Geranium oil	50	0.82 (5.22)	1.51 (7.05)	95.20	91.53	584.50	475.20	13.38	13.03	67.00	26.72
Jatropha oil	50	1.42 (3.67)	3.42 (10.65)	91.70	80.82	425.00	392.70	11.80	12.03	21.43	4.72
Menthol oil	50	0.56 (4.28)	1.32 (6.59)	96.73	92.60	603.10	503.50	13.73	13.67	72.31	34.27
Mustard oil	50	1.35 (6.64)	3.22 (10.33)	92.11	81.94	453.30	394.40	12.10	12.07	29.51	5.17
Neem oil	50	1.31 (6.56)	2.35 (8.81)	92.34	86.82	454.00	404.60	12.53	12.33	29.71	7.89
Check	50	17.10 (27.05)	17.83 (28.23)			350.00	375.00	10.82	10.54		
SEm ±	50	0.11	0.12			11.25	11.58	0.67			
CD at 5%	50	0.34	0.37			33.00	34.18	1.98			

yield (503.5 kg/ha) and 1000-grain weight (13.67 g) was recorded in Menthol treated lots. Per cent decline in disease incidence (92.6%) and increase in grain yield (34.27%) was recorded in Menthol oil treated plots followed by geranium oil and citronella oil. In geranium treated plots disease incidence (1.51%) disease decline (91.53%), 1000 grain weight (13.03 g) and grain yield (475.2 kg/ha) which increase over check (26.72%). In citronella treated plots disease incidence (2.15%), disease decline (87.94%), 1000-grain weight (12.50) and grain yield (465.0 kg/ha) which increased (24%) over check, while Jatropha oil showed lowest grain yield (392.7 kg/ha) and highest diseases severity (3.42%), 1000-grain weight (12.03 g) and grain yield increase over check (4.72%) which was minimum.

The observation recorded on the effect of oils on wilt incidence of vascular wilt and grain yield of lentil revealed that Menthol oil was most effective in reducing the percent wilt incidence as well as increasing grain yield in both the crop season follow by geranium oil and citronella oil. All the treatments were found effective in reducing the wilt incidence. Jatropha oil showed highest disease incidence during both the crop season.. Observed that Neem formulation and Achook was found to be most effective in managing the disease with 89.63% disease control under field condition all the treatments had a positive effect on the plant growth parameter (Chandel and Tomar 2008). Efficacy of water based cruid plant extract of neem, Mexican, marigold, tobacco in controlling soil borne fungi (*Fusarium oxysporum* Scht.f. sp *phaseoli*) (Obonga et al., 2010). *Fusarium* yellows is a disease of common bean caused by *Fusarium oxysporum* the study on phytotoxic properties of four locally available cruid plant extract was aimed at evaluating their efficacy in controlling *Fusarium* Yellows infestation under field condition. (Obonga et al., 2009). Neem decrease disease

severity from 85% , neem not only controlled these diseases but also cause increase in growth character (Hadin et al., 2011). Antifungal properties of *Jatropha curcus* and *Ricinus* extract in the control of mycelia growth and rot development of yam caused by *Fusarium verticilliodes* and *Aspergillus flavus* was investigated in vitro and invivo. (Mukan et al., 2011). Neem (*Azadiractin indica*) seed powder at 50 mg/kg soil increase plant growth and yield significantly and decrease disease incidence. (Haseeb et al., 2005). Jatropha curcus extract at 50% concentration were effective in reducing the mycelia growth of fungus of *Fusarium Oxysporum f.sp.* (Siva et al., 2008). Evaluating the antifungal activity of powder and essential oil formulation of some local medicinal plant (Artemisia, Mentha, Anacyclus). All the treatment significantly reduced the disease incidence and increase the healthy plants (Lakhdar et al., 2010).

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