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Short Research Article

Management of Powdery Mildew Disease of Vegetable Crops by Organic Materials

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Abstract

Major vegetable crops are attacked by large number of pathogens cause various diseases. Among the various diseases, powdery mildew disease is one of the major problems in the vegetable growing hilly areas of Uttarakhand which cause economic losses. So various locally available materials i.e. soapnut, pyrite, cow dung, cow urine, mustard oil etc either alone or in combinations was used to manage the powdery mildew disease. Results revealed that soapnut performed significantly superior over other treatments in controlling the powdery mildew disease followed by treatment pyrite. Soapnut recorded only 14.99% disease severity in case of pea cultivar Arkel while 30.83% disease severity was observed in case of pea cultivar VL-7. Control plots of pea cultivar VL-7 and Arkel recorded maximum disease severity i.e. 95.83% and 84.16% respectively. Green pod yield was significantly maximum in treatment soapnut (90.84 q ha^{-1} in pea cultivar Arkel and 50.19 q ha^{-1} in pea cultivar VL-7) showing 45.65% and 48.15% increase in yield over control in pea cultivar Arkel and VL-7 respectively followed by pyrite treatment. The similar kinds of results were also recorded against powdery mildew of okra. Outcome of the present investigation has clearly highlighted soapnut as a promising potential against powdery mildew disease of pea and okra. It reduced disease significantly as well as stress of pathogen on crop. In organic state, use of soapnut for disease management can be among the most prefer and accessible plant disease management technology especially for poor.

1. Introduction

The overzealous and indiscriminate use of most of the synthetic fungicides has created different types of environmental and toxicological problem (Gurjar et al., 2012). An increasing consciousness about environmental pollution due to pesticides, human health and development of fungicide-resistant strain in plant pathogens has challenged the plant pathologists to search for eco-friendly non-toxic organic compounds for substituting the recommended fungicides in recent years (Meena et al., 2013). Many compounds derived from living organisms have found a use in crop protection. Governments all over the world have focused upon sustainable rural development in an organized way. Rural areas need more economic development in order to match urban centric development. Poverty in rural areas has remained by and large, the main focal point of government and development agencies. Sustainable rural development is the most effective way to eliminate this curse. Soapnuts are fruits of a tree (*Sapindus* spp) belong to family Sapindaceae. It is also known as ritha in kumaon hills. The outer shell of soapnut contains saponin, an all natural surfactant. It also shows antimicrobial properties. These soapnuts are easily available in Kumaon hills of Uttarakhand. Considering its properties, soapnut was exploited to manage the plant disease. Now a day, vegetables cultivation is poised to play a unique role in the hill farming system. Uses of organic products for vegetable disease management in hill agriculture are needed to address for sustainable agriculture as well as rural development. With consumer's awareness and perception, vegetables without residue of chemicals are being preferred in local and export markets. For this purpose plant derived crude products can be eco-friendly, effective and economical for average producers (Gahukar, 2007). Unfortunately the per hectare chemical pesticide usage in vegetable crops for the management of diseases and pests is quite high with a simultaneous increase in the pesticide consumptions.

Powdery mildew is a serious disease of vegetables crops. Pea

powdery mildew is an airborne disease caused by *Erysiphe polygoni* although other fungi such as *Erysiphe trifolii* and *E. baeumleri* have also been reported causing this disease on pea (Fondevilla and Rubiales, 2012). Powdery mildew of okra is caused by fungus *Erysiphe cichoracearum*. Powdery mildew of vegetables especially powdery mildew of pea and okra are the major problems in the most vegetable growing hilly areas of Uttarakhand where the agriculture is mainly rain fed, with very low use of chemical fertilizer and pesticides providing an opportunity to make farms eco-friendly. Although synthetic fungicides are highly effective, their repeated use led to problem such as environmental pollution, risk of resistance development in pathogen and residual toxicity (Yoon et al, 2013). The popularity of botanical pesticides is once again increasing and some plant products are being used globally as green pesticides. Organic materials are safer and eco-friendly in nature so their use in agriculture should be encouraged. In this context, present study was carried by using organic materials to evaluate their potential against powdery mildew disease of pea and okra.

2. Materials and Methods

Field experiments were conducted in randomized block design with eight treatments replicated thrice, at Agriculture Research Station, Majhera at an altitude of 1000 m above mean sea level with latitude of 29.28° N and longitude of 79.32° E. Due to its location, this area is considered as hot spot for powdery mildew disease.

For field trial of powdery mildew of pea, two cultivars of pea i.e. VL-7 and Arkel were sown in 2.5×2.1 m^2 plots by following normal cultural practices. For another trial of powdery mildew of okra, two okra cultivars Arka Anamika and Parbani Kranti were sown in the experimental field with 2×2 m^2 plot size by exposing the crop to highly congenial environment for disease development.

The treatment details and their concentrations are given in Table 1 and Table 2 for the management of powdery mildew disease of pea and okra. The observations for disease severity were taken on 0−5 disease rating scale (Singh and Singh, 1982). Percent data were statistically analyzed and percent disease control (PDC) was calculated on the basis of the following formula (Shivankar and Wangikar, 1993).

$$PDC = \frac{\text{Disease in control plot–Disease in treated plot}}{\text{Disease in control plot}} \times 100$$

3. Results and Discussion

3.1. Powdery mildew of pea

3.1.1. Percent disease severity

Data revealed that soapnut performed significantly superior over other treatments in controlling the disease followed by pyrite (Table 3). Rest of the treatments gave less than 50% control of disease. Pea cultivar VL-7 recorded more disease as compare to Arkel. Soapnut recorded 14.99% disease severity in case of pea cultivar Arkel while 30.83% disease severity was observed in case of pea cultivar VL-7 followed by pyrite which observed 15% (in case of Arkel) and 32.50% disease severity (in case of VL-7). Control plots of pea cultivar VL-7 and Arkel recorded maximum disease severity i.e. 95.83% and 84.16% respectively. All the treatment reduced the powdery mildew by 25.74% to 82.19% in case of pea cultivar Arkel and 43.48% to 67.83% in case of VL-7 over control.

3.1.2. Pod yield

Green pod yield was significantly maximum in treatment soapnut (90.84 q ha^{-1} in pea cultivar Arkel and 50.19 q ha^{-1} in pea cultivar VL-7) showing 45.65% and 48.15% increase in yield over control in pea cultivar Arkel and VL-7 respectively followed by pyrite. All the treatment significantly increases the yield by 9.16% to 45.65% in case of Arkel and 8.22% to

Table 1: List of natural materials and their concentrations for management of powdery mildew disease of pea

Sl. No.	Organic materials	Concentration
1.	Pyrite	0.3%
2.	Cow dung	0.3%
3.	Cow urine	0.3%
4.	Mustard oil plus soapnut	0.3%+0.1%
5.	Cow dung+pyrite+soapnut	0.3%+0.3%+0.1%
6.	Mustard oil+cow urine+soap nut	0.3%+0.3%+0.1%
7.	Soapnut	0.3%
8.	Control	-

Table 2: List of natural materials and their concentrations for management of Powdery mildew disease of okra

Sl. No.	Organic materials	Concentration
1.	Soapnut	0.3%
2.	Pyrite	0.3%
3.	Cow urine	0.3%
4.	Turmeric	0.3%
5.	ST and foliar spray with Cow dung	0.3%
6.	ST and foliar spray with mustard oil+Soapnut	0.3%
7.	ST and spray with *T. harzianum*	1.0 %
8.	Control	-

Table 3: Effects of foliar sprays of different organic materials on severity of powdery mildew and green pod yield of pea

Treatment	Conc. (%)	Arkel				VL-7			
		Disease severity (%)		Yield (q ha^{-1})		Disease severity (%)		Yield (q ha^{-1})	
		Disease severity	Reduction in disease over control	Green pod yield (q ha^{-1})	% increase in yield over control	Disease severity	Reduction in disease over control	Green pod yield (q ha^{-1})	% increase in yield over control
Pyrite	0.3	15.00	82.19	80.94	29.77	32.50	66.08	46.18	36.32
Cow dung	0.3	47.50	43.56	68.08	9.16	54.17	43.48	36.66	8.22
Cow urine	0.3	62.50	25.74	72.37	16.03	48.33	49.57	41.43	22.30
Mustard oil+soapnut	0.3+0.1	57.50	31.68	75.72	21.40	52.50	45.22	39.99	18.05
Cowdung+ pyrite+soapnut	0.3+0.3+0.1	55.00	34.65	73.81	18.34	50.00	47.82	43.34	27.93
Mustard oil+cow urine+soap nut	0.3+0.3+0.1	49.17	41.58	78.09	25.20	46.67	51.30	41.89	23.66
Soapnut	0.3	14.99	82.18	90.84	45.65	30.83	67.83	50.19	48.15
Control	-	84.16	-	62.37	-	95.83	-	33.88	-
CD (p=0.05)	-	8.130	-	2.245	-	7.065	-	1.895	-

48.15% in case of VL-7 over contro (Table 3). Control plots of pea cultivar Arkel recorded 62.37 q ha^{-1} yields while control plots of VL-7 recorded 33.88 q ha^{-1} green pod yields. Treatment cow dung, cow urine, mustard oil either alone or in combination gave almost similar kinds of results in terms of yield.

3. 2. Powdery mildew of okra

3.2.1. Percent disease severity

Data revealed that treatment soapnut performed significantly the best as evident from significantly minimum per cent disease severity followed by treatment pyrite and there is a significant difference in percent disease severity and fruit yield. Treatment soapnut recorded 27.50% disease severity in case of Arka Anamika while 14.17% disease severity were recorded in case of okra cultivar Parbani Kranti followed by treatment pyrite which observed 31.67% and 18.34% disease severity in case of Arka Anamika and Parbani Kranti respectively. Treatment *T. harzianum* gave 35% (in case of Arka Anamika) and 33.34% disease severity (in case of Parbani Kranti). Okra cultivar Arka Anamika recorded comparatively more percent disease severity as compare to Parbani Kranti. Control plots of cultivar Arka Anamika and Parbani Kranti recorded maximum disease severity i.e. 94.16% and 86.67% respectively. All the treatment reduced the powdery mildew disease by 38.93% to 70.79% in case of okra cultivar Arka Anamika and 34.61% to 83.65% in case of Parbani Kranti over control (Table 4).

3.2.2. Fruit yield

Fruit yield was significantly maximum in treatment soapnut (57.57 q ha^{-1} in cultivar Arka Anamika and 67.78 q ha^{-1} in cultivar Parbani Kranti) showing 88.51% and 89.07% increase in yield over control in Arka Anamika and Parbani Kranti respectively followed by treatment pyrite (Table 4). All the treatment significantly increases the yield over control by 15.59% to 88.51% in case of Arka Anamika and 30.32% to 89.07% in case of Parbani Kranti. *T. harzianum* also gave the good results. Treatment cow dung, cow urine, mustard oil, turmeric, either alone or in combination gave almost similar kinds of results in terms of yield.

Present findings have confirmed by earlier workers against powdery mildews (Upadhyay and Singh, 1994; Tripathi et al., 2001). Deore and Sawant (2000) also used some bio-rational treatments against powdery mildew of guar. Patel and Patel (2008) evaluated phyto-extract, fungicides and bio-agents and found that organic treatments did not perform well to increase yield significantly over control.

So far investigation on biocontrol potential of *Trichoderma* spp has been largely concentrated for soil borne diseases but results revealed that *Trichoderma* is also effective against powdery mildew as well. The prevention of infection or suppression of disease by *Trichoderma* is based on hyperparasitism, antibiosis, reduction of saprophytic ability, induced resistance in host

Table 4: Effects of foliar sprays of different organic materials on severity of powdery mildew and fruit yield of okra

Treatment	Conc. (%)	Arka Anamika				Parbani Kranti			
		Disease severity (%)		Yield (q ha^{-1})		Disease severity (%)		Yield (q ha^{-1})	
		Disease severity	Reduction in disease over control	Fruit yield (q ha^{-1})	% increase in yield over control	Disease severity	Reduction in disease over control	Fruit yield (q ha^{-1})	% increase in yield over control
Soapnut	0.3	27.50	70.79	57.57	88.51	14.17	83.65	67.78	89.07
Pyrite	0.3	31.67	66.37	55.10	80.42	18.34	78.84	64.27	79.27
Cow urine	0.3	46.67	50.44	39.82	30.39	40.84	52.88	52.15	45.47
Turmeric	0.3	49.17	47.78	35.30	15.59	46.67	46.15	47.14	31.49
ST and foliar spray with Cow dung	0.3	57.50	38.93	35.85	17.39	56.67	34.61	46.72	30.32
ST and foliar spray with mustard oil+soapnut	0.3	55.0	41.59	37.15	21.64	46.67	46.15	48.39	34.98
ST and spray with *T. harzianum*	1.0	35.0	62.83	41.72	36.61	33.34	61.53	51.61	43.96
Control	-	94.16	-	30.54	-	86.67	-	35.85	-
CD (p=0.05)	-	6.978	-	3.724	-	8.149	-	4.952	-

plant, competition for nutrient and space and reducing spore dessimination and/or restraining of pathogenicity factors of the pathogen which may act co-ordinately and whose importance in antagonistic process depends on several parameter (Elad and Freeman, 2002; Howell, 2003; Harman et al., 2004).

4. Conclusion

Soapnut may be use as preferable and accessible technological innovation for powdery mildew disease management especially for resource poor farmers.

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