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Management of phyllody in fennel by intercropping and insecticide use

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Abstract

Experiments were conducted during 2007–08 to 2010–11 at Centre for Research on Seed Spices, S.D. Agricultural University, Jagudan (Gujarat) for management of phyllody disease in fennel. Minimum incidence (9.80%) of phyllody with highest fennel equivalent yield (3035.28 kg ha^{-1}) was observed in fennel inter cropped with green gram (1: 1). Maximum income Rs. 153632.60 ha^{-1} was observed in fennel + green gram intercropping. Minimum incidence of phyllody (9.19%) with highest yield (1947.17 kg ha^{-1}) was recorded in seedling root dip in 0.04% Imidacloprid plus one spray of 0.005% Imidacloprid after one month of transplanting followed by seedling grown in 40 mesh nylon cloth net.

Keywords: fennel, insecticide, intercropping, management, phyllody

Introduction

Fennel (*Foeniculum vulgare* Mill. syn *Foeniculum officinals* All.) is one of the important spice crops of India which belongs to *Apiaceae* family grown in Gujarat and Rajasthan. Fennel crop suffers mainly due to blight, root rot and powdery mildew diseases (Patel *et al.* 2011). During 2005, a phyllody type disease symptom was noticed at Centre for Research on Seed Spices, S.D. Agricultural University, Jagudan (Gujarat) and nearby farmers field (Bhat *et al.* 2008; Patel *et al.* 2008). The incidence of the disease ranged from 1% to 10% and was characterized by malformation of normal flower to a completely vegetative branch and phyllody symptoms. The cause of disease i.e. phytoplasma was confirmed by PCR analysis and disease was transmitted by leaf hopper. The disease was reported for the first time and no systematic work on management has been carried out. Therefore, a study on management of the disease by intercropping and spraying with insecticide was taken up.

Materials and methods

A field experiment with six intercropping treatments was conducted in a randomized block design with four replications during *kharif* 2007–08, 2009–10 and 2010–11 at Centre for Research on Seed Spices, Jagudan. The seeds of cv. Gujarat Fennel-2 (GF-2) were sown in the last week of June and transplanted in the second week of August at a spacing of 90 × 60 cm in a plot size of 5.4 × 10.2 m (Table 1). Green gram and sesame were sown at onset of monsoon. Recommended agronomic practices were followed for all the treatments. The

observations on phyllody incidence (%), fennel equivalent yield (kg ha^{-1}) and income were recorded as per standard procedures and data analyzed using standard statistical techniques.

A field experiment with five insecticide treatments was conducted in a randomized block design with four replications during kharif 2007–08, 2008–09 and 2009–10 at Centre for Research on Seed Spices, Jagudan. The seeds of cv. Gujarat Fennel-2 (GF-2) were sown in the last week of June and transplanted in the second week of August at spacing of 90 × 60 cm in a plot size of 5.4 × 10.2 m (Table 2). Recommended agronomic practices were followed for all the treatments. The observation on phyllody incidence (%), fennel seed yield (kg ha^{-1}) and benefit-cost ratio (B: C ratio) were recorded as per standard procedures and data analyzed using standard statistical techniques.

Results and discussion

Effect of intercropping

Individual and pooled data revealed significant effect of different treatments (Table 1). The minimum incidence of phyllody disease was found in green gram + fennel (1:1 ratio) (9.80%) followed by fennel as sole crop (12.48%). While maximum incidence of phyllody was in intercropping of sesame + fennel without spraying of Imidacloprid (23.88%) followed by sesame in border line + fennel without spraying of Imidacloprid (22.30%). The pooled data of fennel equivalent yield was also found to be significant and influenced by various treatments (Table 1). Growing of fennel + green gram in 1:1 ratio recorded significantly highest fennel equivalent yield (3035.28 kg ha^{-1}). Growing of sesame in borderline of fennel crop without spraying of imidacloprid recorded minimum fennel equivalent yield (1513.25 kg ha^{-1}). Growing of fennel alone (1853.37 kg ha^{-1}) was at par with fennel crop with borderline of sesame along with spraying of imidacloprid @ 0.005% (1697.53 kg ha^{-1}). Spraying of imidacloprid @ 0.005% increased fennel equivalent yield significantly under fennel + sesame (1:1) intercropping system. Sesame grown in borderline of fennel with spraying of imidacloprid was effective during 2007–08

Table 1. Effect of Intercropping on per cent phyllody infection, fennel equivalent yield and income per hectare

Treatments	Phyllody infection (%)				Fennel equivalent yield (kg ha^{-1})					Income
	2007–08	2009–10	2010–11	Pooled	2007–08	2009–10	2010–11	Pooled	Rs. ha^{-1}
Fennel alone	3.43(11.32)*	4.90(13.41)	4.41(12.72)	4.25(12.48)	1781.50	1804.19	1974.40	1853.37	92743.89
Intercropping of Fennel + Sesame (Til) (Spraying with imidacloprid @ 0.005% after one month of transplanting)	10.05(18.92)	10.78(19.59)	10.54(19.38)	10.46(19.30)	2487.29	2439.18	2364.29	2430.25	121512.65
T_2 + without spraying	15.20(23.30)	15.69(23.68)	16.92(24.65)	15.94(23.88)	2219.50	2203.16	2112.84	2178.50	108881.78
Sesame (Til) in border line + Fennel (Spraying with imidacloprid @ 0.005%)	8.09(16.98)	8.33(17.25)	9.56(18.44)	8.66(17.56)	1732.48	1728.40	1631.72	1697.53	84863.68
T_4 + without spraying	13.60(22.03)	14.21(22.53)	13.98(22.35)	13.93(22.30)	1524.15	1540.03	1475.58	1513.25	74885.32
Green gram + Fennel	1.96(8.93)	2.45(9.85)	2.94(10.63)	2.45(9.80)	2761.89	3325.62	3018.34	3035.28	153632.60
CD (P=0.05)	2.47	1.85	1.91	1.08	91.46	93.50	215.33	241.72	

*Figures in parenthesis are arcsin transformed value; Price of fennel-50/kg; sesame-65/kg; green gram-47

and 2009–10, while the effect was not noticed during 2010–11 and in the pooled data. The maximum income of Rs. 153,632.60 ha^{-1} was obtained by growing of fennel + green gram in 1:1 ratio followed by intercropping of sesame + fennel in 1:1 row spraying with imidacloprid @ 0.005%. Overall minimum incidence of phyllody, maximum fennel equivalent yield and maximum income was observed in green gram + fennel intercropping (1:1). Earlier studies also showed minimum incidence of phyllody with highest fennel equivalent yield in green gram + fennel (1:1) intercropping (Anonymous 2012). Jaiman *et al.* (2010b) also observed minimum incidence of phyllody with highest fennel equivalent yield in green gram + fennel (1:1) intercropping. Sesame crop is highly sensitive to phyllody disease and similar kinds of symptoms and transmitting vector were noticed in fennel.

Effect of insecticide

The pooled data revealed significant effect of different treatments. Minimum incidence of phyllody was found in seedlings grown without nylon cloth net plus seedling root dip in 0.04% Imidacloprid plus one spray of 0.005% Imidacloprid after one month of transplanting (9.19%) followed by treatment of seedlings grown in 40 mesh nylon cloth net (11.61%). The control (seedling grown without nylon cloth net) showed maximum phyllody infection (23.20%) (Table 2). The maximum seed yield was found in seedling grown without nylon cloth net plus root dip in 0.04% Imidacloprid for 10 minutes plus one spray of 0.005% Imidacloprid after one month of transplanting (1947.17 kg ha^{-1}) followed by the treatment of seedling grown in 40 mesh nylon cloth net (1812.52 kg ha^{-1}). The control (seedling grown without nylon cloth net) showed minimum yield of 1560.16 kg ha^{-1}. The maximum net return of Rs. 22,652 with B: C ratio 1:39.38 was obtained from seedlings grown without nylon cloth net plus root dip in 0.04% Imidacloprid for 10 minutes plus one spray of Imidacloprid @ 0.005% after one month of transplanting

Table 2. Effect of spraying insecticide on phyllody infection and fennel yield

Treatments	Phyllody infection (%)				Fennel yield (kg ha^{-1})				B: C ratio
	2007–08	2008–09	2009–10	Pooled	2007–08	2008–09	2009–10	Pooled	
Seedling grown in 40 mesh nylon cloth net	3.19(10.99)*	3.92(12.10)	3.68 (11.73)	3.60(11.61)	1829.16	1804.19	1804.19	1812.52	36.85
Seedling grown in without nylon cloth net (Control)	15.20(23.32)	15.69(23.70)	14.71(22.94)	15.20(23.20)	1560.00	1565.90	1554.56	1560.16	-
T_2 + Seedlings root dip in 0.04% Imidacloprid	10.54(19.37)	12.50(21.12)	9.80(18.70)	10.95(19.73)	1640.80	1638.53	1690.72	1656.68	46.22
T_2 + one spray of 0.005% Imidacloprid after one month transplanting	6.62(15.44)	6.86(15.72)	6.62(15.44)	6.64(15.53)	1762.44	1728.40	1761.08	1750.64	24.57
T_3 + one spray of 0.005% Imidacloprid after one month transplanting	1.96(8.93)	2.20(9.29)	2.21(9.34)	2.12(9.19)	1870.01	1929.01	2042.48	1947.17	39.81
CD (P=0.05)	1.89	2.02	1.92	1.01	109.97	69.42	125.60	58.11	

*Figures in parenthesis are arcsin transformed value; Price of fennel-60/kg; Imidacloprid-980/liter; Nylon Net-20/m; Labour cost-150/day

Table 3. Effect of Intercropping on phyllody infection in fennel

Treatments	Phyllody infection (%)			
	2007–08	2009–10	2010–11	Pooled
Fennel alone	-	-	-	-
Intercropping of Fennel + Sesame (Til) (Spraying with imidacloprid @ 0.005% after one month of transplanting)	10.50(18.91)*	13.20(21.30)	14.75(22.59)	12.82(20.93)
T_2 + without spraying	20.15(26.68)	17.25(24.54)	18.75(25.66)	18.72(25.63)
Sesame (Til) in border line + Fennel (Spraying with imidacloprid @ 0.005%)	9.75(18.19)	12.40(20.62)	13.50(21.56)	11.88(20.12)
T_4 + without spraying	19.20(25.99)	18.30(25.33)	16.40(23.89)	17.97(25.07)
Green gram + Fennel	-	-	-	-

*Figures in bract are aresin transformed values

followed by net return Rs. 14,742 with B: C ratio of 1:36.85 was obtained from seedlings grown in 40 mesh nylon cloth net. Rs. 10,982 with B: C ratio of 1:24.52 in seedlings grown without nylon cloth net plus spray of Imidacloprid @ 0.005% after one month of transplanting and net return Rs. 5,761 with B: C ratio of 1:46.22 was obtained in seedlings grown without nylon cloth net plus seedling dipped in 0.04% Imidacloprid for 10 minutes. Overall, seedlings grown without nylon cloth net plus seedling rootdip in 0.04% for 10 minutes in Imidacloprid plus one spray of Imidacloprid @ 0.005% (0.3 mL^{-1}) after one month of transplanting and seedlings grown in 40 mesh nylon cloth net gave better control of phyllody with higher yield. Earlier studies also showed minimum incidence of phyllody with highest fennel yield when roots were dipped in 0.04% Imidacloprid plus one spray of 0.005% Imidacloprid after one month of transplanting (Anonymous 2011). Jaiman *et al.* (2010a) also revealed that minimum incidence as well as highest seed yield were recorded in seedlings grown without nylon cloth net + seedling root dip @ 0.04% imadacloprid + one spray of 0.005% imadacloprid after one month of transplanting. Akbar *et al.* (2012) reported that imidacloprid 49.4g.a.i. ha^{-1} was effective against potato leaf hopper. Misrah & Senapati (2003) also found that imidacloprid was effective against okra jassid. Besides, Akbar *et al.* (2008) found that imidacloprid was most effective against mustard aphid as compared to endosulfan and biosal.

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