Journal of Crop and Weed, 13(3): 35-38 (2017)

Organic mulching and scaffolding as eco-friendly approach for sustainable management of disease and nematode in pointed gourd (*Trichosanthes dioica* Roxb.)

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Received : 24-01-2017 ; Revised : 25-11-2017 ; Accepted : 30-11-2017

ABSTRACT

A field trial was conducted at instructional farm of Bidhan Chandra Krishi Viswavidyalaya during 2013-14 and 2014-15 to assess the effect of organic mulching and scaffolding as eco-friendly approach for sustainable management of disease and nematode in pointed gourd. The experiment was laid out in Randomized Block Design with seven treatment combinations like paddy straw, water hyacinth, black polythene, rice husk, saw dust, without mulch as control and scaffolding. The results showed that the maximum severity of fruit and vine rot infestation of this crop was recorded in no mulch plots (98.01%) followed by mulching with black polyethylene (93.75) and it was minimum in scaffolding (37.50 %). Control plots recorded maximum percentage of nematode infestation (25.54 %) and lowest in scaffolding (3.44 %). Maximum fresh yield and B: C ratio of pointed gourd (195 q ha^{-1} and 2.45:1 respectively) were recorded in water hyacinth mulched plots.

Keywords : Disease, mulching, nematode, pointed gourd, scaffolding, yield

Pointed gourd (*Trichosanthes dioica*, Roxb.) is a perennial cucurbitaceous vegetable widely grown in Bihar, West Bengal, Eastern Uttar Pradesh and to some extent in Assam, Orissa, Madhya Pradesh and Maharastra (Singh *et al*., 2007). It is one of the remunerative vegetable, grown at large in all parts of West Bengal excepting hill zone of Darjeeling district. The tender fruit is used as a delicious vegetable. It is a dioecious crop propagated vegetatively through vine cutting and root suckers and the crop is available for almost eight months (February to September) of the year (Khan *et al*., 2009). Pointed gourd gets infested with several soils borne diseases like root knot nematode, *Rhizoctonia* root rot, vine and fruit rot (Divya and Sudini, 2013 and Khan *et al*., 2009).Severe infestation with the nematodes like *Meloidogyne javanica* and *Rotylenchus reniformis* can cause complete crop failure in pointed gourd under alluvial soils of West Bengal (Mondal and Khan, 2006). Nowadays, nematode and disease management practices both have become input intensive venture. In modern agriculture non chemical method have been ignored old practice. Due to adoption of chemical methods It has caused health hazard due to to residues left in harvested products and also in soil which ultimately disturbed the food chain(Bahadur *et al*., 2015). Moreover, indiscriminate use of agrochemicals affects normal agro-ecological situation as well as increased cost of cultivation. Use of organic mulches suppress not only weeds and soil-borne diseases but it also have an important role in the production process by adding nutrients to the soil due to microbial activity and helps in carbon sequestration, provides better soil environment by conserving soil moisture, maintaining optimum soil temperature, improving soil fertility and structure of soil, reduced nutrient leaching and may also improves fruit quality (Lamont, 2005; and Jodaugiene *et al*., 2006). The present investigation was undertaken to develop an eco-friendly and sustainable management system to control nematode, disease like fruit and vine rot of pointed gourd in alluvial plains of West Bengal by using different organic mulches and training method.

MATERIALS AND METHODS

A field experiment was conducted during 2013–14 and 2014-15 in Instructional Farm of Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, which falls under the new alluvial zone of West Bengal(23.5^0 N latitude and 89.0^o longitude and 9.75 m above MSL).The experimental soil was sandy loam in nature with optimum fertility status of soil in the availability of N, P_2O_5 and K_2O and pH of soil was 7.5. The experiment was laid out in Randomized Block Design with three replications. Treatment comprises four types of organic mulches (paddy straw, rice husk, water hyacinth and sawdust), synthetic mulch (black polythene sheet), scaffolding and control with no mulch. Pointed gourd root cuttings of local cultivar *Dhepa* were planted on previously prepared pits (45 x 45 x 30 cm), filled with farm yard manure @ 500g pit^{-1} during the second week of October, 2013. Cuttings were planted on raised bed (3 ´ 4 m^2) at a distance of one meter on each side. Irrigation was given as and when required till sprouting is over. Organic mulches were applied on raised bed and scaffolding was made with bamboo sticks and nylon thread during March when vines started trailing. A fertilizers dose of NPK@

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Table 1: Effect of organic mulches and scaffolding on disease, nematode infestation, and yield attributes of pointed gourd

Treatment	Fruit and vine rotseverity (%)			Root knot in fection rate (%)			Number of fruits plant^{-1}			Length of the fruit (cm)			Fruit width (cm)		
	Y_1	Y_2	Pooled	Y_1	Y_2	Pooled	Y_1	Y_2	Pooled	Y_1	Y_2	Pooled	Y_1	Y_2	Pooled
T_1	82.4	85.09	83.75	17.67	19.88	18.77	108.98	112.34	110.66	4.76	6.09	5.42	2.34	2.7	2.52
T_2	77.79	79.7	78.75	10.67	13.69	12.18	128.9	133.1	131	5.55	7.56	6.55	2.67	3.33	3
T_3	90.99	96.52	93.75	8.45	10.7	9.575	123.56	128.44	126	5.12	7.34	6.23	2.35	3.54	2.95
T_4	63.78	69.55	66.66	17.89	20.93	19.41	116	124.66	120.33	5.22	7	6.1	2.32	3.48	2.9
T_5	73.62	78.89	76.25	23.2	24	23.6	113.08	126.26	119.67	5.66	6.34	6	2.44	2.88	2.66
T_6	34.22	40.89	37.50	3.02	3.87	3.44	108	126.66	117.33	4.78	6.85	5.81	2.01	3.19	2.6
T_7	95.09	101.06	98.01	23.09	26	24.54	103.54	114.46	109	3.99	6.26	5.12	1.98	2.49	2.3
SEm (±)	**2.03**	**2.95**	**1.03**	**0.65**	**0.90**	**3.86**	**1.07**	**1.26**	**3.43**	**0.17**	**0.19**	**0.16**	**0.08**	**0.10**	**0.10**
LSD(0.05)	**NS**	**NS**	**3.27**	**1.99**	**2.76**	**11.9**	**3.28**	**3.88**	**NS**	**0.50**	**0.56**	**0.49**	**0.23**	**0.30**	**0.32**

Table 2: Effect of organic mulches and scaffolding on yield attributs ,yield and economics of pointed gourd

Treatment	Number of seed fruit^{-1}			Average fruit weight (g)			Yield kg plot^{-1}			Yield q ha^{-1}			B : Cratio		
	Y_1	Y_2	Pooled	Y_1	Y_2	Pooled	Y_1	Y_2	Pooled	Y_1	Y_2	Pooled	Y_1	Y_2	Pooled
T_1	14.46	18.12	16.29	24.1	26.56	25.33	13.39	15.25	14.32	116.2	122.46	119.33	1.78: 1	1.82: 1	1.80 : 1
T_2	15.2	19.2	17.2	24.75	28.14	26.4	22.52	24.76	23.64	185.11	204.89	195	2.23: 1	2.68: 1	2.45 : 1
T_3	13.55	18.45	16	25.12	27.15	26.13	16.42	20.52	18.47	182.52	190.88	186.7	1.01: 1	1.53: 1	1.27 : 1
T_4	14.98	18.56	16.77	24.95	27.01	25.98	15.24	17.5	17.25	132.31	139.2	135.75	2.1: 1	2.25: 1	2.17 : 1
T_5	15.69	17.56	16.62	24.31	27.15	25.73	14.52	16.92	15.72	123.01	138.99	131	1.61: 1	1.65: 1	1.63 : 1
T_6	15.24	17.5	16.3	24.55	26.82	25.68	13.21	16.7	14.95	118.2	124.96	121.58	1: 1	1.04: 1	1.02 : 1
T_7	15.01	17.7	16.35	24.64	25.84	25.24	13.21	15.1	14.15	116.66	124.25	120.67	1: 1	1.04: 1	1.02 : 1
SEm (±)	**0.59**	**0.63**	**0.75**	**0.96**	**1.04**	**0.12**	**0.93**	**0.65**	**1.18**	**1.57**	**2.24**	**1.71**	**-**	**-**	**-**
LSD(0.05)	**NS**	**NS**	**NS**	**2.94**	**3.19**	**0.37**	**2.85**	**1.99**	**3.73**	**4.84**	**6.88**	**5.27**	**-**	**-**	**-**

Note :Y_1 : First year :Y_2: Second year; T_1 - Paddy straw,T_2 – Water hyacinth,T_3 – Black polythene,T_4 – Rice husk,T_5 – Saw dust,T_6 – Scaffolding,T_7 - Control

80:60: 80 Kg ha^{-1}was applied. Among the biotic stresses root knot nematode and fruit and vine rot disease were most severe during April-July in both the years. A number of infected twigs were observed and was expressed as a rate of root-knot nematode infection. The yield data was recorded by picking of fruits 12- 14 times during April-September. The experimental data were analyzed as per Gomez and Gomez (1984). The treatment comparisons were made using t-test at 5 per cent level of significance. The economics was calculated on the basis of prevailing local market price of pointed gourd and cost of inputs.

RESULTS AND DISCUSSION

The experimental results presented in table 1, showed that significantly maximum severity of fruit and vine rot infestation of this cucurbitaceous vegetable was recorded in no mulch plots (98.01%) followed by mulching with black polyethylene (93.75%) and which was minimum in scaffolding (37.50 %). Mulching with rice husk and saw dust also recorded minimum infestation of fruit and vine rot (66.66 % and 76.25 % respectively). Saha (2002) also reported that growing of pointed gourd over scaffold can reduce the severity of fruit and vine rot infestation in pointed gourd.Control plots recorded maximum percentage of nematode infestation (25.54 %) which was lowest in scaffolding (3.44 %). The present finding was in accordance with Barman *et al*. (2008) in potato, Johnson *et al*. (2000), Ansary and Roy (2005) in watermelon and Hanna (2000) in cucumber. In the case of Scaffolding, nematode infection was found minimum due to less number of roots in contact with the soil but weed growth was high.

After perusal of the experimental data, it was observed that a maximum number of fruits plant^{-1} (131.00) were recorded in the plots mulched with water hyacinth closely followed by black polythene (126.00) and rice husk mulched plots (120.33). Control plots recorded minimum number (119.00) of fruits plant^{-1}. Application of different mulch materials also produced variation for fruit length and width of the pointed gourd. Application of water hyacinth mulch recorded significantly maximum values for fruit length and fruit width (6.55 cm and 3.00 cm respectively) over all the treatments except the plots mulched with black polythene mulch (6.23 cm and 2.95 cm respectively) and rice husk (6.10cm and 2.90 cm respectively). Control plots recorded minimum fruit length (5.12 cm) and fruit width (2.30 cm). Data presented in table 2 showed that no significant variation was observed for a number of seeds fruit^{-1} due to the application of different mulch materials under study. Like other yield parameters, water hyacinth mulched plots showed maximum number of seeds plant^{-1} (17.20) closely followed by covering the plots with rice husk (16.77) and sawdust (16.62) regarding average fruit weight mulching of pointed gourd plots with water hyacinth produced significantly maximum fruit weight (26.40 g) than all other treatments except for blackpolythene mulched plots (26.13 g). Control plots recorded minimum weight of fruit (25.24 g). This result was in accordance with the findings of Khan *et al.* (2015) who recorded higher values for most of the yield attributing characters in sponge gourd due to black polythene mulch. Mulching with water hyacinth and black polythene mulch produced maximum values for all the yield attributing characters of pointed gourd which might be due to favourable soil temperature, moisture etc. for better functioning of the beneficial microbes and on the other hand maximum control of the existing weed flora of pointed gourd. This finding is also in agreement with the results of Cenobio *et al.* (2007) and Arancibia and Motsenbocker (2008) in watermelon.

Significantly maximum fruit yield of pointed gourd (195 q ha^{-1}) was observed in water hyacinth mulched plots followed by plots covered with black polythene sheet (186.70 q ha^{-1}) and rice husk (135.75 q ha-^{1}). control plots recorded minimum fruit yield (120.67 q ha^{-1}). This result was in accordance with the findings of Parmar *et al.* (2013) who found that mulching with black polythene mulch recorded significantly maximum fruit yield of watermelon than other treatments. Higher yield of pointed gourd in the case of water hyacinth was due to rapid decomposition of organic matter which added excess nitrogen and organic carbon in soil. Paddy straw, rice husk and saw dust contains a high amount of lignin where decomposition process was slow and less amount of nutrient was taken up by the plants in compare to water hyacinth. Similar findings have also been reported by Lata and Dubey (2016) and Ram *et al*. (2013). Annette *et al*. (2013)also reported that total yield in tomato was highest in water hyacinth mulched plots compared to other organically mulched plants.

From the present study it may be understood that use of organic mulches like water hyacinth and black polythene and training of vines through scaffolding can be the eco-friendly approach for sustainable management of disease, nematode and cost-effective cultivation practices of pointed gourd under the new alluvial zone of west bengal.

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