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MANAGEMENT OF WILT AFFECTED BLACK PEPPER *(PIPER NIGRUM* L.) GARDENS

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ABSTRACT

The agro-technology for the management of wilt affected pepper gardens was studied for four years. Phytosanitation, rejuvenation of the garden by replacing the wilt-affected vines with high yielding types, replanting after the removal of all pepper vines in the garden, use of amendments, soil nutrient-moisture manipulation, cultural practices and use of pesticides were followed. Economics of management was worked out. Results show that management of the wilt affected pepper gardens is economically feasible.

INTRODUCTION

Among the pepper diseases, quick-wilt or foot rot (caused by *Phytophthora palmivora*) and slow wilt or yellow disease (caused by nematodes) take the heaviest toll of the crop. In a recent survey, Balakrishnan *et al.* (1986) estimated that 1.68 lakh vines perished during 1981-84 due to quick wilt alone in Calicut district amounting to an yield loss of 114 metric tonnes of pepper, and that the disease had spread to about 23% of the cultivated area within three years. de Waard (1979) estimated an annual global loss of 4.5-7.5 million dollars due to foot rot disease in the major pepper growing countries of the world. Information on disease management of pepper is meagre. A study was, therefore, undertaken in 1982-86 in which resort was made to various agro-techniques for the management of wilt diseases.

MATERIALS AND METHODS

The study comprised a field experiment in split plot design with four replications. The experiment was started in 1976 in 1.80 ha land planted with two varieties of pepper (Panniyur-I and Karimunda) trailed on two living standards *(Erythrina indica* and *Garuga pinnata)* and three non-living standards (R.C.C. post, granite post and teak post) with two spacings (3 × 3 m and 3 × 2 m). The pepper vines in this experiment were devastated due to quick wilt disease during July-September 1982. The teak posts were replaced by the live standard *Glyricida maculata* in 1983, as the former got decayed due to white ant attack. The soil is latosol (pH 5.5, C = 1.66%, Bray-P 27 ppm, K 59 ppm, exchangeable Ca 6 m.e. per 100g and exchangeable Mg 2 m.e./100g, Fe 58 ppm, Mn 4 ppm, Zn 0.6 ppm and Cu 2.0 ppm). All the wilt affected vines were uprooted and pits burnt and drenched with 0.2% copper oxychloride @ 5 l/pit and gap filled with Panniyur-I or Karimunda in June 1983 after application of farm yard manure (FYM) at 9 kg/vine. Before planting, one kg neem cake and 0.5 kg bone meal were also added to each pit and mixed with

dolomite @ 1 kg/vine. Rooted pepper cuttings were planted a fortinight thereafter. At the time of planting pepper, phorate was applied at 10g/vine. The vine basins were mulched with green leaves @ 5 kg/vine during November-December every year.

Another field experiment, comprising pepper germplasm planted in 1976, using *E. indica* as standard was devastated due to wilt-diseases in 1982. This plot was used for studying the effect of complete replanting of wilt-affected garden. The soil is latasol (pH 5.3, C 1.44%, Bray-P 13 ppm, K 78 ppm, exchangeable Ca 8 m.e./100g and exchangeable Mg 3 m.e./100g, Fe 14 ppm, Mn 2 ppm, Zn 0.81 ppm and Cu 1.88 ppm). All the vines in the plot were uprooted and replanted with Panniyur-I or Karimunda at 1:1 ratio, after adopting the agrotechniques followed in the case of rejuvenation by gap filling described.

Inorganic nutrients @ 100g N (as urea), 40g P_2O_5 (as Mussoorie phos) and 140 g K_2O (as muriate of potash) were applied to each adult vine. The first half of the nutrients was applied in May-June and second half in August-September. Full dose of nutrients was applied to the plants during the third year only, while in the second year 2/3 of the dose and in the first year only 1/3rd was given.

Vines were sprayed with Bordeaux mixture 1% during May-June and August-September provided there was disease incidence. Bordeaux paste 10% was applied at the collar region of the vine each year in May-June. Disease affected runner shoots alone were clipped off, while other runner-shoots were tied to the standards. Drainage channel was provided at the lower portion of the plots to drain off water from the diseased garden and to increase aeration. Pits of 30 cm^3 were taken between two pepper plants and banana (cv. Mysore poovan) was planted in both the plots for imparting shade to young pepper vines. Phorate was applied at 10 g/pits to control nematodes. Banana was manured with NPK @ 100:200:400 kg/ha. Congo signal *(Brachiaria brizantha)* grass seed was broadcast at 4 kg/ha, and manured with 50 kg each NPK/ha., to reduce summer soil temperature and for keeping the soil firm against soil erosion. The economics of the disease management was worked out.

RESULTS AND DISCUSSION

Rejuvenation of the diseased gardens

Rejuvenation of the disease affected gardens was accomplished by (1) removal of the diseased vines and gap filling and (2) replanting after the removal of all the vines in the garden.

Data (Table I) show that after the incidence of wilt disease, significantly higher survival (12.32%) was registered in Panniyur-I as compared to Karimunda (4.48%) showing that under field condition quick wilt infection in Panniyur-I was less than in Karimunda. Kueh Tiong Kheng (1979) reported that in Sarawak, variety Kuching was very susceptible to quick wilt. while Sarma *et al.* (1982) in India, reported that Narayakodi, Kuthiravally, Uthiran Kotta and Balankotta registered lower percentage infection due to quick wilt as compared to other varieties.

Table I. *Relative percentage of survival of black pepper varieties trailed on different standards**

Standards / Varieties	*Erythrina indica*	*Garuga pinnata*	R.C.C. post	Granite post	Teak post	Mean
Panniyur-I	25.98	13.94	8.79	7.46	5.44	12.32
Karimunda	7.29	6.25	4.16	1.56	3.12	4.48
Mean	16.63	10.09	6.48	4.51	4.28	8.90

*After the incidence of wilt disease in 1982
C.D. for varieties 3.75. C.D. for standards 5.93

As regards survival of pepper vines trailed on to different standards, those trailed on *E. indica* registered a significantly higher percentage of survival (16.63) than those on other standards (Table I). This may be attributed to factors like shade, mulching effect due to shedding of leaves of live standards, increased organic matter status in the soil etc. due to decomposition of leaves shed from the standards like *E. indica* or *G. pinnata*.

Rejuvenation by gap filling

After rejuvenation of the diseased garden by gap filling, the recurrence of the disease over the years was very low i.e. 4.52% (Table II). The differences among the varieties with regard to recurrence of the disease was not significant, and this obviously shows that rejuvenation with individual replanting of the diseased vines and adopting agrotechnology is one of the efficient methods of disease management.

Rejuvenation by replanting

With regard to the replanting of the diseased garden after the removal of all the vines, the recurrence of the disease

Table II. *Incidence of quick wilt disease in black pepper varieties after rejuvenation by gap filling (Mean percentage)*

Varieties / Standards	Year 1984			Year 1985			Overall mean
	Panniyur-I	Karimunda	Mean	Panniyur-I	Karimunda	Mean	
Erythina indica	3.01	6.30	4.65	6.13	5.55	5.84	5.24
Garuga pinnata	4.33	6.07	5.20	5.73	4.62	5.17	5.18
Glyricidia maculata	9.43	7.69	8.56	4.11	7.13	5.62	7.09
R.C.C post	3.99	3.06	3.53	2.08	4.39	3.23	3.38
Granite post	0.98	2.02	1.50	0.98	2.95	1.96	1.73
Mean	4.35	5.03	4.69	3.81	4.93	4.37	–
Overall mean	–	–	–	4.08	4.98	–	4.52

Table III. *Incidence of foliar yellowing in black pepper varieties after rejuvenation by gap filling (Mean percentage)*

Varieties Standards	Year 1984 Panniyur-I	1984 Karimunda	1984 Mean	1985 Panniyur-I	1985 Karimunda	1985 Mean	Overall Mean
Erythina indica	3.00	1.31	2.16	4.45	3.12	3.79	2.97
Garuga pinnata	1.04	0.52	0.78	1.04	0.52	0.78	0.78
Glyricidia maculata	0.46	1.04	0.75	0.52	0.52	0.52	0.64
R.C.C post	1.04	0.98	1.01	0.52	1.04	0.78	0.89
Granite post	1.04	0.98	1.01	1.44	0.52	0.98	0.99
Mean	1.32	0.96	1.14	1.59	1.14	1.37	–
Overall mean	–	–	–	1.45	1.04	–	1.25

over the years was only very meagre (3.0%). Panniyur-I registered lower disease incidence (2.8%) as compared to Karimunda (4.8%).

Foliar yellowing

The incidence of foliar yellowing (Table III) was very low (1.25%) over the years, after gap filling the diseased garden. Among the varieties, Karimunda (1.04%) seems to be less susceptible than Panniyur I (1.45%) in getting foliar yellowing over the years.

After replanting of the diseased garden, recurrence of foliar yellowing over the years was very low (2.32%), Karimunda registered lower percentage (1.85%) as compared to Panniyur-I (2.8%).

Nutrient Management

The application of NPK, liming and the increased microbial activities induced by the addition of neemcake, FYM and bonemeal together with dolomite resulted in an overall beneficial nutrient balance which would have contributed towards better establishment and yielding from rejuvenated gardens.

Grass cover helped conditioning the soil due to its root effect and improvement of soil structure besides checking soil splashing and reducing summer soil temperature. Another contributory factor for lessening the disease could well be the drainage channel which helped in increasing soil aeration.

Economics

Data in Table IV show that an overall benefit-cost ratio during the third year was 2.09 per ha for rejuvenation by gap filling and ratio of 1.73 per ha for rejuvenation by adopting replanting in the management of the diseased pepper gardens.

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Table IV. *Cost/Benefit analysis of one hectare wilt diseased pepper garden by gapfilling as well as by replanting methods*

Years	Investment in rupees: Pepper by gap filling	Pepper by replanting	Return in rupees: By gap filling Pepper alone	By gap filling Pepper+ banana	By replanting Pepper alone	By replanting Pepper+ banana
1	9075	9500	3050	13675	–	10625
2	8850	8900	15050	25675	10000	20025
3	9060	9300	27375	38000	23750	34375
Overall cost-benefit ratio for 3 years	1:2.09	1:1.73				

Investment cost for banana for 1,2 and 3rd year is Rs. 3500/- Rs. 2695/- and Rs. 2505/-
Return from banana is Rs. 10,625/- ha/year

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