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Effect of crop rotation on population dynamics of *Ralstonia solanacearum* in tomato wilt sick soil

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Bacterial wilt of tomato (*Lycopersicon esculentum* Mill. norms cons.) caused by *Ralstonia solanacearum* Yabuuci) is one of the most destructive diseases of this crop and it is most widespread in tropical, sub- tropical and warm temperate regions of the world. The pathogen is serious in various states in India causing severe loss in yield (4). Several reports on management of this disease through soil amendments (7, 8) are available with little emphasis on crop rotation (6). The present study was undertaken to work out cultural options (crop rotation) for the disease management by starving the bacterial pathogen in soil.

An experiment was initiated during rainy season of 1994 with eleven different crop combinations to be followed in rotation, viz., (i) okra & cowpea-cabbage- cucumber (ii) maize – spinach – cucumber (iii) ragi – radish – French bean (iv) cowpea- pea-maize (v) ragi – radish – French bean (vi) maize – carrot – cucumber (vii)okra – maize- radish (viii) okra & cowpea- maize – radish (ix) ragi- maize – maize (x) maize –ragi – maize and (xi) tomato-tomato –tomato (control). The crops were sown during their respective growing season. The trial was laid out in RBD with three replications with 3m x 2.7m plot size in wilt sick field. Standard crop husbandry of different crops was followed.

Soil samples were collected from each plot at the beginning of the experiment. After completion of one full rotation, soil samples were again collected at 4-months interval, i.e. in the month of June, October and February during 1995-97. After completion of all the crop rotations (24 months), the main crop tomato (Pusa Ruby susceptible cv.) was transplanted in treated plots at the distance of 45 x 60 cm and standard crop management practices were followed and repeated twice in rainy and winter seasons. Data on plant survival were recorded. Residual population of *R. solanacearum* was determined six times at four months interval on 2,3, 5–Triphenyl Tetrazolium Chloride (TTC) medium and statistically analyzed.

The mean initial population of the pathogen was 40.2 x 10^4 cfu/g soil in sick soil ranging from 17.8 x 10^4 cfu to 85.4 x 10^4 cfu/g soil which was non significant showing 129.0% coefficient of variation. The eleven combinations of crop rotation tried to contain the primary inoculum of *R. solanacearum* for 28 month in wilt sick soil, revealed that the reduction in bacterial population over the initial population was highly significant in rotations where ragi- French bean – okra (67.7%), maize – spinach – watermelon (62.1%), okra – maize – radish (54.9%), maize – carrot – cucumber (41.8%) and maize –cabbage-cucumber (16.9%) were used. Increase in bacterial population over the initial population was recorded in tomato –tomato-tomato (164.6%) and okra + cowpea –maize – radish (94.5%). The bacterial population hardly increased in those treatments in which cereal crops were grown viz. maize – ragi- maize and maize – ragi – maize which were at par among themselves.

Ralstonia population varied in different months. The mean bacterial population was reduced (57%) after one rotation (16 month of observation) after that the population increased (20 month observation) and remained at par in 24 and 28 months. The result indicated that the after two year of rotation the mean bacterial population was stable.

Table 1. Effect of crop rotation on residual population of *Ralstonia solanacearum* in tomato

Treatment	Initial popopulation cfu x10⁴/g	*Ralstonia solancearum* population cfu/g x 10⁴ (after months)				Mean
		16	20	24	28	
T_1 Maize-cabbage-cucumber	21.1	21.0	12.0	19.5	17.5	17.5
T_2 Maize-spinach-watermelon	59.8	10.1	17.1	25.8	37.5	22.6
T_3 Ragi-French bean-okra	85.4	13.3	28.1	31.3	41.8	28.6
T_4 Cowpea-pea-maize	22.4	20.8	57.6	21.5	44.3	36.0
T_5 Ragi-radish-French bean	18.5	14.0	46.0	44.5	35.8	35.0
T_6 Maize-carrot-cucumber	56.4	14.5	32.8	39.6	44.1	32.7
T_7 Okra & maize-radish	70.5	13.6	13.1	60.8	39.3	31.7
T_8 Okra+cowpea-maize-radish	19.7	11.0	34.3	54.1	54.0	38.3
T_9 Ragi-maize-maize	30.2	18.8	34.0	37.0	29.0	29.7
T_{10} Maize-ragi-maize	35.4	28.5	18.1	35.0	38.3	30.0
T_{11} Tomato-tomato-tomato	17.8	24.0	85.1	40.3	39.5	47.2
Mean	40.2	17.2	34.4	37.2	38.3	31.8
CD at 5%	NS					
(A) month = 7.3; (B) treatment = 10.0; Interaction – $A(B_1 - B_0)$ = 20.0; $B(A_1 - A_0)$ – 20.4						
CV (%)	129.0					

Further there was a highly significant variation in *Ralstonia* population due to interaction of month and treatment after one rotation (i.e. 16 month) the population was significantly reduced in crop rotation maize- spinach-watermelon (10.1 x 10^4 cfu /g soil, 83% reduction), ragi-French bean–Okra (13.6 x 10^4 cfu/g soil, 80.6% reduction) over the initial population and later on the population in these crop rotations were hardly increased. However, the population in other crop rotations were increased after 20 months indicating ineffectiveness of these crop rotations in reducing the bacterial population.

In the present investigation okra- maize- radish, ragi-French bean– okra, maize–carrot–cucumber have significantly reduced the primary inoculum in soil indicating either maize or ragi should be included in the crop rotation. Rao and Ramkishum (5) reported that cowpea–maize-cabbage, okra-cowpea-maize, maize-okra-radish, maize-cowpea-maize, ragi-brinjal(tolerant var)-bean was very helpful in reducing the native inoculum. Similarly, Sohi *et al.* (6) reported that with two years rotation of *Vigna* sp. followed by maize and cabbage or okra followed by *Vigna* sp. and maize gave effective control of *Pseudomonas solanacearum* whereas Michel *et al.* (2) reported that *Burkholderia solanacearum* population declined after cowpea and rice but not after brinjal. Cowpea intercropping reduced the bacterial wilt in Taiwan (3) whereas Adhikari and Basnyat (1) observed significantly reduction in bacterial wilt in intercropping with/rotation with maize, okra, cowpea and resistant line of tomato (CL1131) in Nepal.

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