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Effect of soil types and some minerals on development of wilt disease of pigeonpea

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The effect of soil types and some minerals on development of wilt disease of pigeonpea was studied. The loam soil showed maximum mortality. Similarly acidic soil showed maximum percentage of disease control. Amongst the minerals calcium sulphate caused maximum decline of the disease.

Key Words : Pigeonpea, soil types, minerals, wilt disease

INTRODUCTION

The soil types and commonly used fertilizers affect plant growth not only directly but indirectly through their effect on disease incidence and severity. They may affect the pathogen's growth, its aggressiveness, the antagonistic soil microflora or host's resistance. This paper deals with the effect of soil types and some minerals on development of wilt disease of pigeonpea caused by *Fusarium udum*.

MATERIALS AND METHODS

Sand, clay, loam, acidic, alkaline and fallow soils were collected from different sites and brought to the laboratory. The pots containing the soil samples were inoculated with 1% (w/w) *Fusarium udum* mass cultured on wheat grains (Singh, 1996), and were kept at room temperature (30°C) for five days to allow the pathogon to establish well in soil and light watering of the pot was done.

Surface sterilized seeds of susceptible variety (Bahar) of pigeonpea *(Cajanus cajan)* were sown in above pots, at the rate of 10 seeds per pot at a depth of 1.5 cm. Three replicates were used for each combination. Observation of disease development was made regularly but the final per cent wilting of plants was noted after 45 days of sowing. The per cent mortality and per cent disease control was calculated by the following formulae :

$$\text{Mortality \%} = \frac{\text{No. of seedlings in un inoculated soil} - \text{No. of seedlings in inoculated soil}}{\text{No. of seedlings in uninoculated soil}} \times 100$$

$$\text{\% disease control} = \frac{\text{Mortality (\%) in check} - \text{Mortality (\%) in treatment}}{\text{Mortality (\%) in check}} \times 100$$

To see the effect of calcium, phosphorous and potassium on development of *Fusarium* - wilt of pigeonpea, sufficient soil samples from pigeonpea field were collected and brought into laboratory. The soil was air dried at room temperature (30°C) for 24 hrs and then ground with the help of mortar and peslte and seived through 2 mm pore size sieve. The pot containing soil was well mixed with 1% (w/w) pure inoculum of the pathogen and kept for 5 days at room temperatures (30°C) to allow the pathogen to establish well in soil. Light watering of the pot was done to maintain adequate moisture. Calcium (calcium sulphate) was amended in the pots containing 1 kg soil at the rate of 1%, 2% and 3% (w/w). Phosphorous (single superphosphate) was amended in pots at the rate of 25 mg, 50 mg, and 75 mg because field rate of single superphosphate is 40-50 kg per hectare. For potassium, murriate of potash was amended in pots at the rate of 10 mg, 20 mg and 40 mg. The pots containing soil-pathogen mixture were served as control. Percent mortality and percent disease control were determined as described above.

RESULTS

The results on effect of soil types on mortality (%) and disease control (%) are presented in Table 1. The loam soil showed maximum mortality (86%) followed by clay (83%), sand (76%) and acidic soil (70%). Similarly acidic soil showed maximum percentage of disease control (30%) while loam soil exhibited the minimum (13%). The seedling in alkaline soil did not emerge even after one month. The CD value for different texture and types was found statistically insignificant.

Table 1 : Effect of soil types on wilt disease of pigeonpea

Types of Soil	Disease condition	
	Mortality (%)	Disease control (%)
Sandy	76.6	23.3
Clay	83.3	16.6
Loam	86.0	13.3
Acidic	70.0	30.0
Alkaline	*	*

CD at 1% level = 17.68226 (Insignificant)
* Seeds not germinated

It is evident from the Table 2 that 3% calcium caused maximum decline in the disease (46.6%) followed by phosphorous (33%) and potassium (26%) at 75 mg and 40 mg concentrations, respectively. In general, the increase in the concentrations of Ca, P and K increased the percentage of disease control. The mean values of percentage of disease control in different concentrations of calcium, potassium and phosphorus was statistically highly significant (P=0.01).

Table 2 : Effect of calcium (w/w), phosphorus (mg/kg soil) and potasium (mg/kg soil) on wilt disease of pigeonpea

Disease condition	Minerals concentration								
	Calcium (%)			Phosphorus (mg)			Potassium (mg)		
	1	2	3	25	50	75	10	20	40
Mortality (%)	73.3	66.6	56.6	83.3	73.3	66.6	86.6	75.6	73.3
Disease control (%)	26.6	33.3	43.3	16.6	26.6	33.3	13.3	23.3	26.6

CD at 1% level of P = 13.69673 (Significant)

DISCUSSION

It is apparent from the table that soil type affects the disease severity in soil. It is obvious from the result that higher control of the disease was observed in sandy soil (23%) than loan soil (13%). Similarly acidic soil showed greater percentage of disease control (30%). In the acidic soil, due to formation of mucigel (Jenny and Grössenbacher, 1962) in the rhizosphere region the entry of pathogen is restricted which is most pronounced possibly in sandy soil. This reason could be attributed for maximum percentage of control of wilt disease of pigeonpea. In other soils, however, the mucigel formation either restricted physiochemical nature of soil, or their formation was influenced by some biotic interferences in the rhizosphere area. Similarly the mucigel formation in acidic soil is favoured and therefore highest percentage of control of wilt disease of pigeonpea (30%) was encountered under the present investigation. During such interferences the soil aeration, which is more frequent in sandy soil, possibly accelerated the whole phenomenon of disease control.

Calcium, phosphorus and potassium all could control the wilt disease. Calcium controlled the disease upto 43% at 3%, phosphorus, 33% at 75 mg and potassium, 26% at 40 mg. Similar findings were reported by Hallock and Garren (1968), Bateman (1964), Bateman and Beer (1965), and James and Woltz (1970). A contact exchange has also been observed in rhizosphere zone showing a jelly like coating (mucigel) on the outer surface of root by Jenny and Grössenbacher (1962).

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