Table 2. Interaction effect of root rot fungus and cyst nematode on height of the plant, dry weight of shoot and root rot maturity.

S. No.	Treatments	Plant ht. * (cm)	Shoot wt. * (g)	Root wt. * (g)
1.	Fungus alone	16.15[a]	0.883[a]	0.480[ab]
2.	Nematode alone	16.48[a]	1.098[a]	0.490[b]
3.	Fungus inoculated first and nematode inoculated 7 days later	16.40[a]	1.070[a]	0.408[ab]
4.	Nematode inoculated first and fungus inoculated 7 days later	16.25[a]	0.808[a]	0.358[a]
5.	Fungus and nematode inoculated simultaneously	19.50[b]	1.150[b]	0.413[ab]
6.	Uninoculated control	20.10[c]	1.765[c]	1.733[c]

* Mean of four replications
In a coloumn means followed by a common letter are not different significiantly at 5 % level by DMRT

Table 3. Interaction effect of root rot fungus and cyst nematode on pod yield.

S. No.	Treatments	Pod * (no.)	Total pod wt. / pot * (g)
1.	Fungus alone	24.3[b]	8.22[b]
2.	Nematode alone	59.0[c]	19.91[c]
3.	Fungus first inoculated and nematode inoculated 7 days later	23.0[b]	7.94[b]
4.	Nematode firstinoculated and fungus inoculated 7 days later	11.5[a]	3.97[a]
5.	Fungus and nematode inoculated simultaneously	24.8[b]	8.36[b]
6.	Uninoculated control	63.3[c]	24.42[d]

* Mean of four replications
In a coloumn means followed by a common letter are not different significiantly at 5 % level by DMRT

Siddiqui, Z.A., and Husain, S.I. (1991). Interaction of *Meloidogyne incognita* race-3 and *Macrophomina phaseolina* in a root-rot disease complex of chickpea. *Nematol. Medit.* **19** : 237-239.

(Received : November 1998 ; Revised : July 2000)

Madras Agric. J., 87(1-3): 101 - 104 January - March 2000
https://doi.org/10.29321/MAJ.10.A00430

Soil fertility evalution of lower Vellar basin in Tamil Nadu

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Abstract : Both surface and subsurface soil samples representing Entisol, Alfisol and Inceptisol consisting 13 soil series were studied for the preparation of the soil fertility classification in the Lower Vellar basin area of Pudukottai district. 'd' (dry condition), 'b' (basic reaction), 'm' (magnesium deficiency); 'k' (potassium deficiency) and 'i' (Fe-P fixation) were the important soil condition modifiers for the study area. The study area reveals that 13 soil series under the scheme of fertility capability classification made possible to arrive 11 FCC units, comprising of 11 type / substrata type and 5 condition modifiers which serve as the basis for conducting fertility related experiments. *(Key Words : Fertility evaluation, FCC, Vellar basin)*

Fertility Capability Classification (FCC), a technical soil classification system based on soil properties known to affect crop response to fertilisation, should be useful in improving fertilizer

recommendations (Denton *et al.*, 1987). The occurance of soil fertility constraints are quantified in the form of condition modifiers (Buol *et al.*, 1975; Sanchez *et al.*, 1982; Mathan, 1990). Under this scheme, only those factors which are recognised to play a direct role in the interaction of soil materials and fertilizer are included. An attempt has been made to use this concept in Lower Vellar basin of Pudukottai district.

Materials and Methods

The soil samples, representative of 13 soil series of Pudukottai district, Tamil Nadu were collected for this investigation from upper 20 cm (or) plough layer whichever was shallower. Subsoil samples from 20-50 cm of the surface were collected depending on the particular boundary and texture of the soil.

'Type' which is the highest category under the FCC system was determined by the mean texture of the surface soil. The 'substrata type' was the texture of the subsoil that occurs within 50 cm of the surface soil. Condition modifiers which refer to soil chemical and physical properties of the plough layer or top 20 cm was also assessed.

Mechanical analysis was carried out by International Pipette method (Piper, 1966) and soil reaction by Beckman pH meter using a soil water ratio of 1:2. Electrical conductivity was estimated by supernatant solution from pH estimation using Elico conductivity meter. Cation exchange capacity and exchangable cations (Ca, Mg, K and NA) were estimated by the ammonium acetate method (Jackson, 1973).

Results and Discussion

The properties of the soils are presented in Table 1. The soil sample coding for the 13 soil series are furnished in Table 2. The condition modifiers relevant to the study area were (i) dry condition/ustic moisture regime 'd' (2) basic reaction 'b' with soil pH more than 7.3 (3) magnesium deficiency 'm' for exchangeable Mg less than 2.3 cmol (p+) kg^{-1} (4) 'k' deficiency when exchangeable 'K' content is less than 0.2 cmol (p^+) kg^{-1} (5) Fe-P fixing (i), inferred from the soil colour (hues redder than 2.5 YR).

The soil reaction ranged from strongly acid to neutral. According to Buol *et al.* (1975) acidity which retards the growth of sensitive crops between pH 5 and 6 is 'h' modifier. In the present study, soils of Aliyanilai, Nayakarpatti, Pudhuarimalam and Vengalangadu can be classified under 'h' modifier. The soils can be corrected by lime application.

'Ustic' moisture regime was recorded from climatic data of Pudukottai district. The area is dry and the rainfall is scanty with mean annual precipitation of 539 mm. The mean annual air temperature is 30.1°C and 24.53°C and is classified under isohyperthermic with respect to soil temperature regime. Therefore, the condition modifier 'd' was used in the present study. Inclusion of this modifier suggests the need for supplemental irrigation during the growing periods of crops for better response due to fertilizer application and to avoid extensive crusting problem in the area (Shanmugam *et al.*, 1995; Mathan *et al.*, 1986). Occurrence of 'd' modifier alone was spread over 7.17 per cent of the total area of Vellar watershed. Modifier 'd' in combination with 'k' occurred in 38.13 per cent of the regions.

The local modifier 'm' suggested by Mathan (1990) for the soils with low exchangeable Mg less than 2.3 cmol (p^+) kg^{-1} was also considered in this study. It covered an area of 13.44 per cent of the surveyed area. The area was nearly levelled with zero to one per cent slopes. Application of Magnesium fertilizer would be more helpful in alleviating this deficiency.

Introduction of the condition modifiers and local modifiers into each of the series examined reduced it to 11 FCC units comprising of 11 type/ substrata type and 5 condition modifiers (Table 3) requiring similar type of fertility management practices.

The 'kb' combination modifiers were seen in 10.80 per cent of the area in Vellar watershed. Similarly 'dkm' 'di', 'dm' and 'dikb' combinations were recorded is 18.72, 13.20, 5.25 and 6.65 per cent of the watershed.

If 'k' modifier alone is considered, it was recorded in 9 out of 13 pedons studied, which were spread over an area of 71.70 per cent of watershed. Similarly 'm', 'b' and 'i' modifiers occur in 13.44, 15.70 and 28.00 per cent of the total surveyed area. It is thus seen from the above, that ustic moisture regime and potassium deficiency are the major fertility constraints in this regions.

It could be concluded that interpretation of soils under the scheme of fertility capability classification made possible to arrive 11 FCC units, comprising 11 type / substrata type and 5 condition modifiers which serve as the basis for conducting fertility related experiments and direct extrapolation of such experimental results within a FCC unit for easy adoption.

Table 1. Relevant soil properties for fertility capability classification

Soil Series	Depth (cm)	Soil Colour (dry)	Clay (%)	Texure	pH (1:2)	CEC [c mol (p⁺)kg⁻¹]	Exchangeable cations [c mol (p⁺)kg⁻¹]				ESP
							Ca^{2+}	Mg^{2+}	K^{+}	Na^{+}	
Aliyanilai	0-24	5YR 5/6	13.15	sl	5.00	17.10	7.0	4.0	0.12	0.86	5.02
	24-70	5YR 5/6	15.82	sl	6.30	24.10	9.0	5.0	0.17	1.02	4.25
Nayakarpatti	0-17	10YR 5/3	4.93	ls	5.90	14.80	6.5	2.5	0.12	0.71	4.79
	17-34	10YR 6/6	21.21	scl	4.70	17.50	7.5	3.5	0.12	0.86	4.91
	34-68	10YR 6/6	20.21	scl	5.60	17.20	8.0	4.5	0.11	0.93	5.40
Madathupatti	0-14	10YR 5/4	6.06	ls	7.10	16.70	6.0	3.0	0.16	2.11	12.63
	14-23	10YR 4/4	8.93	ls	7.60	15.80	4.0	3.0	0.10	2.34	14.80
	23-51	10YR 5/8	38.02	c	8.00	18.00	8.0	2.5	0.10	2.31	12.80
Kamakshipuram	0-18	10YR 6/1	5.15	s	6.50	15.10	4.0	2.0	0.08	0.74	4.90
	18-74	10YR 6/6	8.29	ls	6.50	17.30	6.0	4.5	0.08	1.12	6.47
Tanjur	0-21	10YR 6/2	15.23	sl	7.60	16.30	7.0	3.0	0.13	2.10	12.80
	21-44	10YR 5/4	8.29	ls	7.70	18.40	6.0	3.5	0.08	2.64	14.34
	44-48	10YR 5/4	9.06	ls	7.50	14.40	4.5	2.5	0.11	2.11	14.15
Arimalam	0-13	10YR 5/4	33.91	cl	6.60	20.80	8.0	4.5	0.21	2.50	12.01
	13-38	2.5YR 4/6	33.86	cl	7.40	21.90	7.0	3.5	0.17	2.75	12.55
Vambam	0-13	2.5YR 4/6	19.46	sl	6.60	17.10	8.5	4.0	0.24	0.52	3.02
	13-35	2.5YR 4/8	33.28	sl	5.60	17.40	7.5	3.5	0.22	0.42	2.41
	35-59	2.5yr 4/8	35.92	sl	5.40	17.50	8.0	4.5	0.17	0.53	3.08
Mattupatti	0-15	10YR 5/4	31.26	sc	6.50	18.50	7.0	2.0	0.25	1.24	6.70
	15-34	10YR5/4	12.31	sl	6.80	16.50	5.0	1.5	0.26	1.64	9.93
	34-62	10YR 6/4	16.21	sl	6.70	15.90	5.5	2.5	0.24	1.73	10.88
Perianayagi puram	0-20	10YR 4/4	15.23	l	7.70	17.40	6.5	2.5	0.12	2.60	14.90
	20-46	10YR 5/6	33.41	c	8.20	16.30	5.0	2.0	0.10	2.40	14.70
Purakudikadu	0-28	2.5YR 4/6	33.21	c	7.40	21.20	7.0	3.5	0.19	2.55	10.40
	28-109	7.5YR 5/6	34.11	c	8.30	24.40	5.5	3.0	0.11	2.18	11.01
Pudhuarimalam	0-12	7.5YR 5/6	34.98	c	5.30	20.70	5.0	3.5	0.27	1.42	6.85
	12-39	7.5YR 5/6	34.21	c	6.90	19.80	7.0	4.5	0.16	1.86	9.29
Adappankara chatram	0-10	10YR 7/4	6.15	s	6.10	15.00	5.5	3.5	0.14	1.22	8.13
	10-39	7.5YR 5/6	13.11	sl	5.90	17.40	5.0	3.0	0.12	1.01	5.80
Vengalangadu	0-20	10YR 5/6	6.90	ls	5.11	6.10	5.5	2.0	0.12	0.96	5.96
	20-43	10YR 5/6	6.12	ls	5.10	16.30	6.5	2.0	0.18	0.81	4.91

Table 2. Fertility capability classification - soil sample coding

Soil series	Type/ substrata type	Modifiers	Check list												Slope	FCC unit
			d	e	a	i	v	k	b	n	m	s	x	c		
Aliyanili	L	dk	x	-	-	-	-	x	-	-	-	-	-	-	0-1%	Ldk (0-1%)
Nayakarpatti	SL	dk	x	-	-	-	-	x	-	-	-	-	-	-	1-3%	SLdk (1-3%)
Madathupatti	SC	kb	-	-	-	-	-	x	x	-	-	-	-	-	0-1%	SCkb (0-1%)
Kamakshipuram	S	dkm	x	-	-	-	-	x	-	-	x	-	-	-	0-1%	Sdkm (0-1%)
Tanjur	LS	kb	-	-	-	-	-	x	x	-	-	-	-	-	0-1%	LSkb (0-1%)
Arimalam	L	d	x	-	-	-	-	-	-	-	-	-	-	-	0-1%	Ld (0-1%)
Vambam	LC	di	x	-	-	x	-	-	-	-	-	-	-	-	0-1%	LCdi (0-1%)
Mettupatti	CL	dm	x	-	-	-	-	-	-	-	x	-	-	-	0-1%	CLdm (0-1%)
Perianayagipuram	LC	kb	-	-	-	x	-	x	x	-	-	-	-	-	0-1%	LCkb (0-1%)
Purakudikadu	C	dikb	x	-	-	x	-	x	x	-	-	-	-	-	1-3%	Cdikb (1-3%)
Pudhuarimalam	C	-	-	-	-	-	-	-	-	-	-	-	-	-	0-1%	C (0-1%)
Adappankarachatram	SL	dk	x	-	-	-	-	x	-	-	-	-	-	-	1-3%	SLdk (1-3%)
Vangalangadu	L	dkm	x	-	-	-	-	x	-	-	x	-	-	-	1-3%	Ldkm (1-3%)

Table 3. Frequency of occurrence of condition modifier combinations and per cent to the total area

S.No	Modifier combination	Frequency of occurrence	Percentage of the total sample	Pedon number	Percent of total area
1	d	1	7.69	6	7.17
2	dk	3	23.08	1, 2, 12	38.13
3	kb	3	23.08	3, 5, 9	10.80
4	dkm	2	15.38	4, 13	18.72
5	di	1	7.69	7	13.20
6	dm	1	7.69	8	5.25
7	dikb	1	7.69	10	6.65

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(Received : October 1998 ; Revised : May 2000)