

Proposed C. Changprai, 1973  
Revised by :  
P. Vijarnsorn and staffs, 1988  
W. Sirichuaychoo, 2004

## MAKHAM SERIES

Field Symbol: Mak

**Distribution:** Occupies a small extent in the areas of Southeast Coast of Thailand.

**Setting:** Makham soils are development from alluvium and occurred on alluvial plain. Relief is level to nearly level. Slopes are 2 percent or less. Elevation is from 20 m to 30 m above mean sea level. The climate is Tropical Monsoon (Koppen 'Am'). Average annual precipitation is from 2,000 to 3,400 mm. Average annual air temperature is 27°C.

**Drainage, Permeability and Surface Runoff:** Drainage is somewhat poorly drained, permeability is rapid over slow and surface runoff is slow. Ground water level is within 1.5 m of the surface almost the year.

**Vegetation and Land Use:** mainly low open dipterocarp and short grass with scattered bushes and shrubs.

**Characteristic Profile Features:** The Makham series is a member of the coarse-loamy over clayey, siliceous over kaolinitic, subactive, nonacid, isohyperthermic Fluvaquentic Eutrudepts (soil taxonomy, 2003). They are very deep soils and are characterized by a dark grayish brown or dark brown fine sandy loam surface or Ap or A1 horizon overlying a very pale brown, pink or pinkish gray loamy sand A2 horizon which in turn overlies a pinkish gray or white clay or sandy clay 2B horizon. Mottles of strong brown, yellowish brown and/or yellowish red occur throughout the profile. Strongly acid to moderately acid, reaction values range from 5.5 to 6.0 at the surface and slightly acid to moderately alkaline, reaction values range from 6.5 to 8.0 in the subsoil.

**Typifying Pedon:** Makham sandy loam - low open dipterocarp forest, from near by Ban Pa-Yat, Amphoe Makham, Changwat Chanthaburi, 20 m above mean sea level, less than 2 percent slopes (sheet number 5449 III).

**Profile Code Number:** SE-17/22, described by S. Kitiyarak and C. Chaengprai, 17 January 1973 (moist colors unless otherwise stated).

Horizon Depth (cm)	Description
A1 0-10	Dark brown to brown (7.5YR4/2) sandy loam; common fine distinct yellowish red (5YR5/6) mottled along roots channels; weak coarse subangular blocky structure; slightly firm, slightly sticky and slightly plastic; common fine interstitial and few fine tubular pores; many fine and medium roots; strongly acid (field pH 5.5); clear slightly wavy boundary.
A2 10-22	Grayish brown (10YR5/2) and pinkish gray (7.5YR6/2) sandy loam; many fine distinct strong brown (7.5YR5/6) and yellowish red (5YR5/6) mottled along roots channels; weak coarse subangular blocky structure; slightly firm, slightly sticky and slightly plastic; few fine interstitial and tubular pores; common fine, medium and few coarse roots; moderately acid (field pH 6.0); clear smooth boundary.
AE 22-40	Very pale brown (10YR7/3) sandy loam; common fine distinct strong brown (7.5YR5/6) and yellowish red (5YR5/6) mottled along roots channels; weak coarse subangular blocky structure; friable, nonsticky and nonplastic; common fine and medium interstitial pores, few very fine and fine tubular pores; many fine, few medium and coarse roots; few fine scattered subrounded iron nodules; slightly acid (field pH 6.5); gradual smooth boundary.
E 40-60	Pinkish gray to pink (5YR7/2-3) loamy sand; common medium and few fine distinct strong brown (7.5YR5/6) and yellowish red (5YR5/6) mottled; very weak coarse subangular blocky structure; friable, nonsticky and nonplastic; common very fine and fine interstitial pores, few very fine and fine tubular pores; few fine

2Bg 60-100 roots; few fine and medium subrounded iron nodules; neutral (field pH 7.0); abrupt smooth boundary.  
 White (10YR8/1) clay loamy; abundant coarse distinct strong brown (7.5YR5/6) and common medium yellowish red (5YR5/6) mottled; moderate coarse subangular and granular blocky structure; extremely firm, sticky and plastic; many fine and medium interstitial pores, common fine and few medium tubular pores; few fine roots; common fine and few medium subrounded iron nodules; neutral (field pH 7.0).

**Type Location:**

Name of district, Amphoe Makham, Changwat Chanthaburi.

**Range of Profile Features:**

The surface or A1 or Ap horizon sandy loam, is from 10 to 25 cm in thickness and has 10YR or 7.5YR hues, values 3 to 5 and chromas 2 to 4. Texture of loamy fine sand may occur. Structure is very weak medium subangular blocky. Very strongly acid to moderately acid, reaction values range from 5.0 to 6.0.

The subsoil A2 horizon sandy loam or sandy clay loam, has 5YR, 7.5YR or 10YR hues, values 5 to 7 and chromas 2 to 4. Structure is weak fine or medium blocky. Very strongly acid to neutral, reaction values range from 5.0 to 7.0.

The 2Bg horizon sandy clay loam or clay loam, has 10YR or 7.5YR hues, values 6 to 8 and chromas 2 or less. Structure is moderate and weak medium and coarse blocky. Texture of sandy clay may occur. Moderately acid to moderately alkaline, reaction values range from 6.0 to 8.0.

**Similar Soil Series:**

**Principal Associated Soils:**

ANALYSIS RESULTS

(oven dry basis)

Profile code No.: SE-17/22

Soil series: Makham series (Mak)

Lab No.	Depth (cm)	Horizon	Particle size distribution analysis (% by weight)								Texture		pH		CaCO <sub>3</sub> %	P, mg kg <sup>-1</sup> Bray 2	K, mg kg <sup>-1</sup> NH <sub>4</sub> OAc
			USDA grading			Sand-fraction grading					Lab	Field	1:1	1:1			
			sand	silt	clay	vc	c	m	f	vf	result	estim <sup>n</sup>	water	KCl			
Pd-1877	0-10	A1	59.5	35.5	5.0						sl	sl	4.1	3.8	1.0	1.9	32
Pd-1878	10-22	A2	70.0	24.5	5.5						sl	sl	4.4	4.0	0.7	1.6	24
Pd-1879	22-40	AE	61.0	31.5	7.5						sl	sl	4.6	4.0	0.3	1.9	21
Pd-1880	40-60	E	81.0	15.0	4.0						ls	ls	6.0	4.5	0.7	1.6	18
Pd-1881	60-100	2Bg	35.0	25.5	39.5						cl	cl	6.6	5.8	0.3	1.6	32

Depth (cm)	Air dried to oven dried	C %	N %	Exchange capacity and cations (cmol <sub>(+)</sub> kg <sup>-1</sup> )										Base satur <sup>n</sup> (%)		ECEC cmol <sub>(+)</sub> kg <sup>-1</sup> (B+D)	AI KCl extr. cmol <sub>(+)</sub> kg <sup>-1</sup> (D)	Electrical conduct <sup>y</sup> (ECx10 <sup>6</sup> ) dS m <sup>-1</sup>
				Ca	Mg	K	Na	SUM cations (B)	Extr. acidity (A)	SUM (B+A)	CEC NH <sub>4</sub> OAc (C)	CEC 100g Clay	B/Cx100	(Bx100)/(B+A)				
0-10	0.4	1.45		0.20	0.10	0.05	0.20	0.55	9.20	9.75	2.6	52.0	21	6			0.31	
10-22	0.1	0.69		0.20	0.06	0.04	0.30	0.60	0.40	1.00	1.1	20.0	55	60			0.09	
22-40	0.5	0.46		0.20	0.06	0.02	0.30	0.58	1.10	1.68	1.3	17.3	45	35			0.07	
40-60	0.7	0.13		0.20	0.05	0.05	0.20	0.50	0.40	0.90	0.3	7.5	100	56			0.02	
60-100	2.0	0.35		5.40	2.10	0.10	0.50	8.10	1.60	9.70	8.8	22.3	92	84			0.20	

Surveyor: S. Kitiyarak & C. Chaengprai

Reported by: W. Sirichuaychoo

Date: Jan. 17, 1973

Date: Nov. 5, 1998