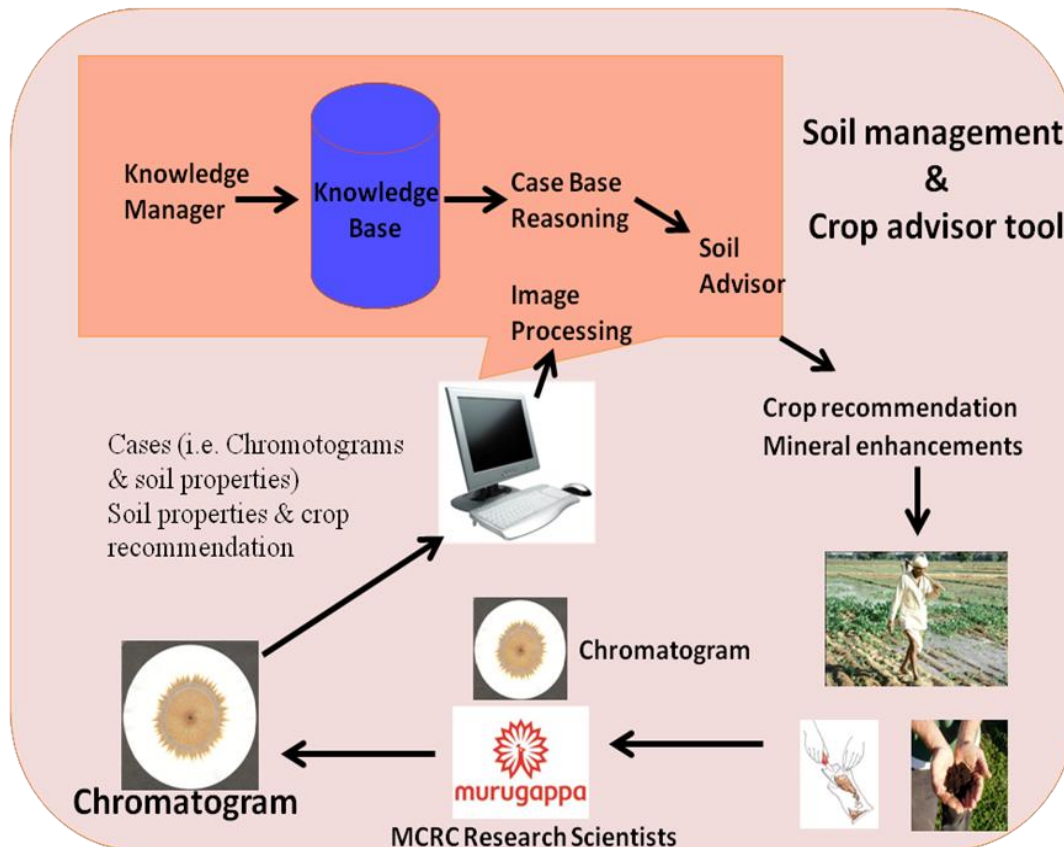


Technology on
“Alternative Analytical Technology for
Soil Nutrient Analysis through Image
Processing Chromatograms”

Collaboration with IIT-M

A Project funded by Department of Science and Technology,
Government of India, New Delhi



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Title : **Alternative analytical technology (AAT) for Soil
Nutrient analysis through image processing of
Chromatograms**

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Importance of soil testing: Indian agriculture occupies an eminent position in global cultivation of rice, wheat, sugarcane, pulses and vegetables. Sustainable agriculture should carefully consider maintaining and improving the existing soil structure and innate productive capacity of this soil. Mere application of chemical fertilizer and over working with soil without taking into consideration, the virgin soil health (microorganism, humus, organic matter etc) would in the long run counterproductive. It is in this context, one must view the importance of soil testing. It is the basic information for the farmer to decide, the extent of fertilizer and farm yard manure to apply at various stages of the growth cycle of the produce. Also such soil testing must provide sufficient information on trace elements available in the virgin soil there by lead to a strategy of maintaining the health of the soil over many years, and making up the depletion by adding micro nutrient, to the soil by biological or mineral application.

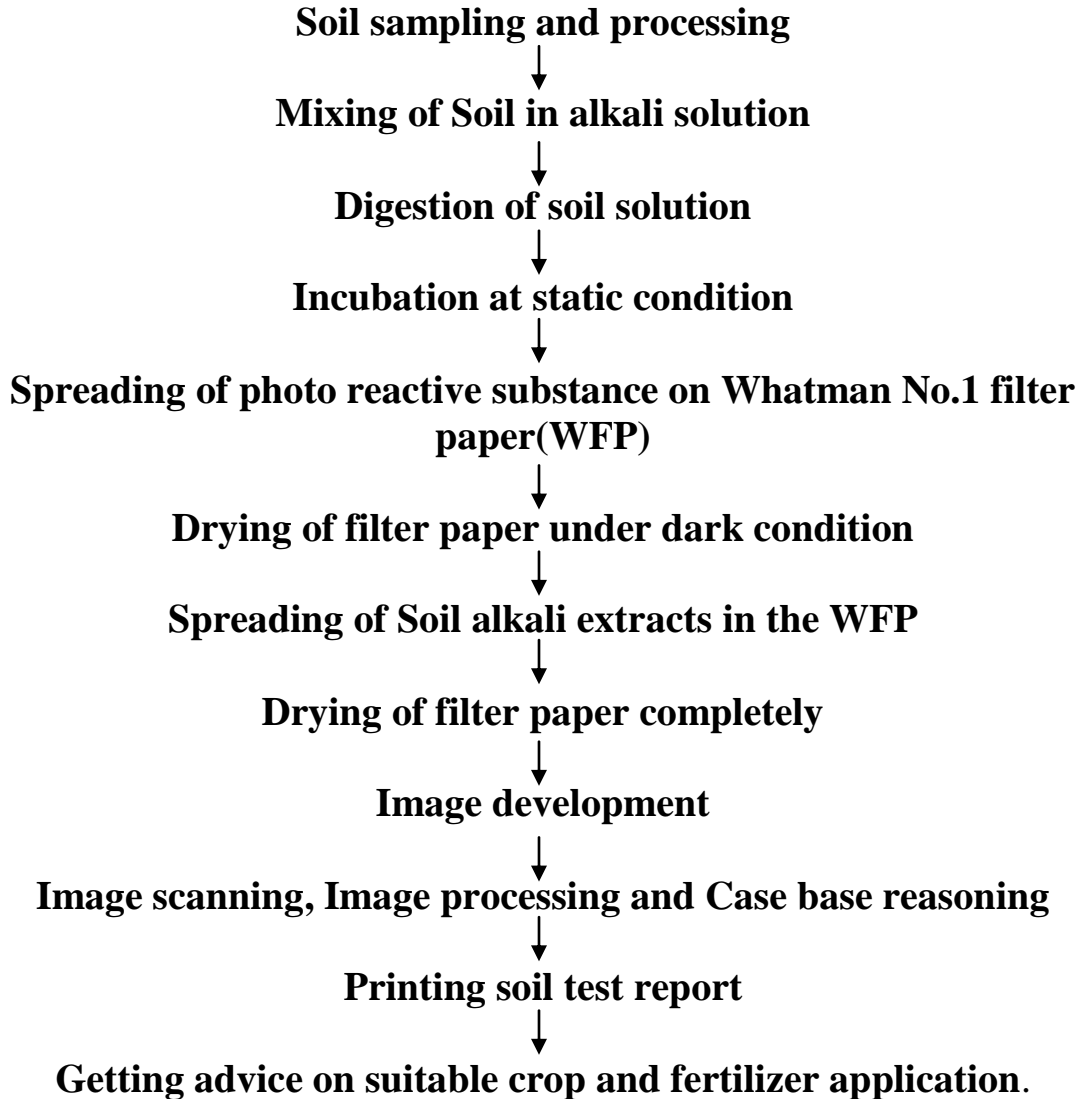
Why alternative analytical technology (AAT) for soil testing:

There is no simple, cost effective and reliable technology available to determine the level of organic carbon, humus, nitrogen, phosphorus, potassium and micronutrients (10) in soil so as to provide the farmer the information he requires for maintaining the health of the soil. The present methods that are available require sophisticated, costly and equipment. Depending on the information required, the cost of testing a single soil sample could vary between Rs. 250 to Rs. 1250 per soil).

AAT for testing soil nutrients: Shri AMM MCRC and IIT Madras has jointly undertaken a project titled “Integrated Knowledge Systems on Soil Nutrient Analysis through Image Processing of Chromatograms” funded by Department of Science & Technology and Murugappa Group for a period of 3 years. More than 12,000 soil samples have been processed for the determination of physicochemical properties, circular Paper chromatograms, image processing and case based reasoning. Software for image processing of soil chromatogram so as to know the

soil composition, fertilizer recommendation and best suitable crop has been developed by us and was tested at various levels.

AAT Process:



Quantification of Soil nutrients: The three primary nutrients Viz Nitrogen, Phosphorus, and Potassium (kg/acre), three secondary nutrients Calcium, Magnesium and Sulfate and six micronutrients of sodium, Boron, Copper, Iron, Manganese, Molybdenum and zinc (mg/kg or ppm), all making up a figure of 13 and organic carbon (%) and humus (kg/acre) in the soil are being critically analyzed through the case based reasoning system. In addition to macro and micro nutrients, pH and EC are also determined through AAT.

Accuracy: The new technology AAT developed gives acceptable level of accuracy (>90%) for all nutrients except Organic Carbon (70%), Sulfate (72%) and Zinc (80%) compared with conventional analytical methods.

Advantages of AAT: The advantages of this alternative analytical technology on quantification of soil nutrients are simple, reliable, require no sophisticated equipment, quick testing of soil nutrients (18 properties), advice on soil input based on the test report, advice on best suitable crops, should help the farming community and at an affordable cost.

Duration: The analysis and the test report through AAT will be completed within one day.

Disadvantages of AAT: Though AAT is simple and cost effective, the farmers are still dependent on expertise available with experts.

Who Can benefit: Soil science laboratories in universities, Agriculture colleges, Research organizations, Fertilizer companies, Government / Non governmental organization working on agriculture.



DST



IITM-AIDB



MURUGAPPA GROUP

Soil Test Report

Sample ID: 2CIKS1

Village: Kanchipuram

Collection Time: 17.05.2011

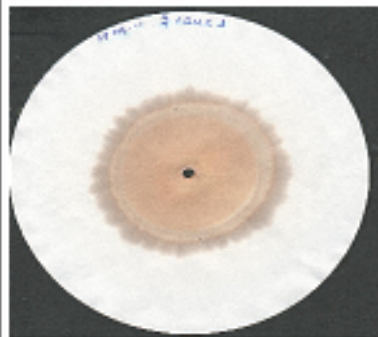
Farmer's Name: CIKS

Taluk: Kanchipuram

Date of analysis: 03/06/11

pH:	7.58	Boron:	0	mg / kg	
EC:	0.58	Molybdenum:	0	mg / kg	
Organic Carbon(OC):	0.51	kg / acre	Sulfate:	9.9	mg / kg
Organic Carbon(OC):	0.58	%	Humus(HA):	78.75	kg / acre
Nitrogen(N):	132.58	kg / acre	Total Minerals:	234.82	kg / acre
Phosphorous(P):	11.83	kg / acre	Bacteria:	0	10 ⁸ cfu / gm
Potassium(K):	90.4	kg / acre	Azotobacter:	0	10 ⁸ cfu / gm
Calcium:	484.25	mg / kg	Azospirillum:	0	10 ⁸ cfu / gm
Magnesium:	172.23	mg / kg	Rhizobium:	0	10 ⁸ cfu / gm
Sodium:	117.05	mg / kg	Actinomycetes:	0	10 ⁸ cfu / gm
Iron:	9.58	mg / kg	Fungi:	0	10 ⁸ cfu / gm
Manganese:	8.51	mg / kg	Protease:	0	µg Tyr/g/hr
Copper:	1.42	mg / kg	Cellulase:	0	mg Glu/g/day
Zinc:	1.05	mg / kg	Invertase:	0	µmol lu/g/day
		Alk. Phos:	0	µg prp/g soil/hr	

Image of Soil Chromatogram



Nutrient	Low	Medium	High	Nutrient	Low	Medium	High
N (kg/acre)	<113	113-182	>182	Iron (mg/Kg)	<8	8-8	>8
P (kg/acre)	<18	18-36	>36	Mn (mg/Kg)	<1	1.2-2.5	>2.5
K (kg/acre)	<80	80-138	>138	Cu (mg/Kg)	<0.3	0.3-1	>1
OC (%)	<0.75	0.75-1.5	>1.5	Zn (mg/Kg)	<0.5	0.5-1	>1
Mg (mg/kg)	<10	10-15	>15	Sulphur (mg/Kg)	0-10	10-15	>15
HA (Kg/Acre)	<18	18-31	>31				

*The physico-chemical properties of soil were determined by following an alternative analytical indigenous technology developed by MCRC, IIT (M) with financial assistance from Department of Science & Technology, GOI, New Delhi and Murugappa Group.

Nutrient Level	Ca (mg/kg)	Boron (mg/kg)	Molybdenum (mg/kg)
Sufficient	>300	>0.5	>0.2
Deficient	<300	<0.5	<0.2

Date:

Analysed By:

Approved By:



DST



IITM-AIDB



Sample Id : 2CIKS1	Name : CIKS	MGC : Others
Village : Kanchipuram	District :	State :
Customer No :	Date of collection : 17.05.2011	Report Time : 03/06/2011 11:32:31

Parameter	Value	Status	Parameter	Value	Status
Soil Type	*		Zinc	1.05 ppm	Deficient
pH	7.58	Slightly alkaline	Boron	*	*
EC	*	*	Manganese	8.51 ppm	Sufficient
OC	0.51 %	Medium	Copper	1.42 ppm	Sufficient
Nitrogen	132.58 Kgs/Acre	Medium	Iron	9.58 ppm	Sufficient
Phosphorus	11.83 Kgs/Acre	Medium	Molybdenum	*	*
Potassium	90.4 Kgs/Acre	Medium	Sodium	117.05 ppm	*
Sulphur	9.9 ppm	Low	Sulfate	9.9 ppm	*
Calcium	464.25 ppm	Sufficient	Humus (HA)	76.75 Kgs/Acre	*
Magnesium	172.23 ppm	Sufficient			

Fertilizer Recommendation

Crop Name: MANGO 3		Season: All Seasons		Source Type: Others	
Product	Quantity (Grams/Tree)	Product	Quantity (Grams/Tree)		
Godavari Gold	200	Godavari DAP	652		
Gromor Sulphur	100	Gromor potash	500		
Chamatkar	5				
Godavari urea	397				

Split Dose Particulars:

Stage	Dosage
Puddling	Total Organic Manure, Total Chamatkar
Basal	Total phosphorus, Total Gromor Sulphur, 1/3 Potassium
Top1	
Top2	

Crop Name: Paddy		Season: Rabi		Source Type: Irrigated	
Product	Quantity (Kgs/Acre)	Product	Quantity (Kgs/Acre)		
Godavari Gold	200	Gromor 20:20	120		
Gromor Sulphur	10	Gromor potash	27		
Chamaiker	0.5				
Godavari urea	52				

Split Dose Particulars:

Stage	Dosage
Puddling	Total Organic Manure, Total Chamaiker
Basal	Total phosphorus, Total Gromor Sulphur, 1/3 Nitrogen, 1/2 Potassium
Top1	1/3 Nitrogen
Top2	1/3 Nitrogen, 1/2 Potassium

Chromotogram Image of Soil Sample



Estimate of capital requirement for setting up one AAT soil testing laboratory (Approximately 50 soil samples / day)

Details	Units	Cost (in Rs.)
i) Equipments		
1. Filter paper marking device (Indigenous fabrication)	1	7,000
2. Orbital shaker (120 rpm) - KAVIN	1	38,500
3. Weighing balance (SHIMADZU BL220H)	1	31,000
4. Chromatogram box Vertical- Multitray	1	40,000
5. Drying table (5''X8'') (50 samples to dry) (Indigenous fabrication)	1	21,000
6. Paper cutter (size 16'')	1	700
7. Computer (DELL Inspiron 580s desktop i3 processor, 2GB RAM, 320 GB hard disk capacity)	1	30,000
8. Printer and Scanner (HP Laserjet M1536dnf MFP, print, copy, Scan, Fax, Network)	1	23,000
ii) Glasswares & Materials		
1. Conical flask (250ml capacity @ Rs.90/flask) (Borosil)	100	9,000
2. Watch glass @ Rs.7 (Borosil)	100	700
3. Micropipette 1ml @ Rs.3150 and 5ml @ Rs.3650/pipette (Riviera)	1 each	6,800
4. Plastic Trays	10	1000
iii) Miscellaneous	Lot	10,000
iv) Technology fee**		4,00,000
v) Hand holding and follow-up activities (Travel once in 3 months for monitoring the lab @Rs.10,000)		40,000
Grand Total (i to v)		6,58,700

*Available building or existing laboratory can be considered (Approximate size 20'x15')

**Onetime payment (Non exclusive basis), Technology fee includes technical training on AAT to the license for two persons for three days.

*** Royalty (4%) to be paid on net income / Rs.4 per soil sample cost.

Recurring cost (50 soils/day x 25 days = 1250 samples/month)

Details	Recurring cost Rs. / Month (25 days for 1250 soil samples)	Cost / soil sample (Rs.)
A) Man Power (2)	15,000	12.00
1. Lab Manager (1) Rs.10,000/month		
2. Lab Assistant (1) Rs.5,000/month		
B) Consumables		
1. Distilled water – Rs.1/1000ml(50ml/soil)	63	00.05
2. Whatman No.1 Filter paper (2 sheets @ Rs.8/sheet)	20,000	16.00
3. AgNO ₃ – 25 gms @ Rs.2500 – SRL Brand(0.5% - 1ml/soil)	625	00.50
4. Wick paper (3X3 cm, 2 wicks)	875	00.70
5. NaOH – 500g - SRL Brand @ Rs.200 (1% 50ml/soil)	500	00.40
6. Butter sheet (1 coir -80 sheets @ Rs.40)	2500	02.00
7. Stand by Generator/ Electricity charges for drying (800 lux, 12hrs)	1250	01.00
C). Contingency		
1. Printing papers 500 sheets/ bundle @ Rs.225 (4 sheets /soil testing report)	2250	01.80
2. Miscellaneous charges (Light, Fan fitting etc.,)	2500	02.00
D). Infrastructure / Building charges (Rs.3000/Month)	3000	2.40
E). Royalty per sample	5000	4.00
Overall cost/soil	52,563	42.85
Income(Say, collection of testing Charges Rs. 100 / soil)	1,25,000	100
Net Income (Collection charges- monthly expenditure for Testing soil samples)	72,437	57.15

Technology protection: The technology on alternative analytical technology for soil testing is protected under patent application (652/CHE/2008).

Technology Transfer: The technology on AAT shall be transferred to national and international entrepreneurs. Technological assistance is available in MCRC for setting-up of laboratory on AAT for soil nutrients testing.

Further Details, Please Contact

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