SOIL TESTING LABORATORY

1 Brief Description of Project

In India Fertilizer application and consumption is highly unorganized with wide variations. The NPK ratio, which is the measure of balanced use of fertilizer, shows wide inter-state and inter-crop disparity. Though there has been an impressive growth in the consumption of fertilizers in post green revolution period, their indiscriminate use has been one of the reasons for declining productivity in recent years. Studies and Evaluations have revealed that the lack of adequate soil testing facilities and related advisories have forced the farmers to depend on unreliable sources for advice on the fertilizer requirement, which is one reason for the unbalanced fertilizer use.

Soil test based nutrient management has emerged as a key issue in efforts to increase agricultural productivity and production since optimal use of nutrients, based on soil analysis can improve crop productivity and minimize wastage of these nutrients, thus minimizing impact on environmental leading to bias through optimal production. Deficiencies of primary, secondary and micronutrients have been observed in intensive cultivated areas.

Odisha is a state with different physiographic and agro-climatic zones. Soils are generally fertile, but some deficient and problematic soils need proper management. The problem soils of Odisha can be grouped into three, classes, viz. 1. Upland, low fertile, low water retentive acidic soils. 2. Low land soils posing iron toxicity problems and 3. Coastal salt affected soils. About 2/3 rd. of the cultivated area in the state is highly to mildly acidic in reaction. More area can be brought into cultivation if the problematic soils are properly reclaimed and managed. As for soil fertility status is concerned nitrogen, phosphorous & potassium content of soils of Odisha are generally low to medium and micro-nutrient deficiencies especially Zn and B are of common occurrence. Soil test constitute the basis to assess the type and extent of problem and the needed management to reclaim such soils. These facts clearly demonstrate the utmost need to establish more and more soil testing labs in the State.

1.1 Objectives of Soil Testing

1. To estimate the available nutrient status (macro, secondary and micro-nutrients)of soils.
2. To assess the type and extent of problem for reclamation of problematic soils
3. To evaluate the fertility status of soils of a country or a state or a district.

By soil test summaries the fertility status i.e. available nitrogen status or available phosphorous status or available potassium status expressed as **High, Medium or Low**. A soil fertility map showing such fertility status can be prepared. The soil fertility map can be used for -

- Delineating areas of nutrient (e.g. N, P, K) sufficiency or of deficiency,
- Studying soil fertility changing pattern due to crop cultivation over a period of years,
- Determining nutrient (e.g.N, P, K) requirement for the deficient areas etc.
- To prepare a basis for fertilizer recommendation, lime recommendation or gypsum recommendation.

2 Existing scenario

Several States including Andhra Pradesh, Gujarat, Haryana, Karnataka and Uttar Pradesh have made commendable progress in soil testing programme in various ways such as expansion of soil testing facilities, popularization of the programme in campaign mode, development of soil fertility maps and use of information technology in delivering soil nutrient status and appropriate recommendation to farmers.

2.1 Status of Soil Testing Laboratory in Odisha

Odisha has around 60 Soil Testing Laboratories which are being funded by different government agencies. These laboratories are full filling the soil test need of the farmers. Earlier farmers were mainly dependable on Agricultural universities for their soil testing;however, to provide the facility at farmers door steps, the Govt has now initiated mobile soil-testing laboratories (vans) in five districts of Odisha. viz. are Cuttack, Mayurbhanj, Sundargarh, Ganjam and Koraput.

2.2 Existing Status of Soil Testing Facilities

Table 1: Existing Status of soil testing facilities in Odisha

Number of Soil Testing Laboratories	**Before the beginning of 11th Plan, there were 11 static and 1 mobile laboratories.**
Annual analyzing capacity	The analyzing capacity of 12 labs was 1, 20,000 samples per year. The capacity is being increased with establishment of new labs and strengthening of existing labs. At the end of the 11th Plan, it is expected that there would be 60 Static STLs and 24 mobile STLs. The projected analyzing capacity is about 4, 00,000 samples per year.
Review of functioning	The State Govt. has extensively reviewed the program and proposed its strengthening to increase the analysis capacity from 1,20,000 samples per year to 4,00,000 samples per year.
Constraints	Shortage of scarce andqualified manpower hampers the functioning ofthe labs. Short term hiring and out sourcing is one of theways to carry out work. Such personshowever,would need intensive training before undertaking the task.
Monitoring	Functioning of the Soil testing labs is monitored by the Director of Agri& Food Production. Soil testing Lab at Bhubaneswar has been declared as a Nodal Lab that will undertake monitoring of quality in soil testing program.
Involvement of State Agricultural University(s)	The Orissa University of Agriculture and Technology (OUAT) provide scientific and technical support to the program. It remains effectively involved in the program.
Soil health cards	• Already 10 lakh cards have been provided, based on last 10 years of soil test data. • Soil testing kits have been provided to all blocks for analyzing 200 samples per block. Based on such analysis, during last 3 years i.e. 2007-08 to 2009-10 a total of 96,207 soil health cards have been issued. • With the enhanced analyzing capacity, 4,00,000 soil health cards are expected to be issued .
Additional labs, Static and mobile are planned to be set up	22 static and 23 mobile labs are proposed to be established by the State Govt.
Strengthening existing soil testing laboratories for micronutrient testing	Seven labs are being provided with AAS facilities for micronutrient testing. • It is planned to collect 55.000 geo referenced soil samples from the entire State covering all the gram Panchayats and will be analyzed for Secondary and Micronutrients.
Staffing of laboratories	The process has been initiated to place core staff in the newly created labs (as well as filling up vacant posts in the old labs) and engaging the supporting staff through short term hiring and out sourcing.

Preparation of Soil Fertility Maps.	Soil Fertility Map has been prepared based on last 10 years data. In future, this practice will continue. It has been planned to prepare digital district maps and make the same web enabled so as to cater the requirement of farmers and other users in remote corner of the State.
Popularizing soil test based application of fertilizers including demonstration and publicity.	• Popularization of integrated nutrient management for maintaining soil health is a major mandate cited in the State Agriculture Policy. Farmers are encouraged to practice INM and special assistance is being provided to use organic manure, bio-fertilizers and soil amendments etc. • There are large acidic areas in the State hence PhosphoGypsumis being supplied to the farmers @ Rs. 14.25 per 50 kg bag. Paper mill sludge is also supplied @RS. 10 per 50 kg bag. The recommendations are soil test based. The use of these products will supply calcium and sulphur. These elements are helpful in oil seed crops grown in acid Soils

Source: www.agricoop.nic.in

Admissible items and list of equipment for setting up of Soil Testing Laboratory with annual analyzing capacity of 1,00,000 samples per annum (For analyzing NPK, secondary nutrients and micronutrients in soils and water)

3.1 Elements to be analysed.

While carrying out the complete analysis of soil, following categories of elements are normally determined:

a) N, P, K (Major nutrients)

b) Ca, Mg, S (Secondary nutrients)

c) Zn, Fe, Cu, Mn, B, Mo, Cl (Micro nutrients)

Besides these nutrients soil are also analysed for followingproperties

a) pH

b) ECE

c) Organic carbon

3.2 Benefits.

The laboratory is primarily used for soil testing, This Laboratory will also provide the extension advisory to the farmers. Along with the testing reports, the farmers will also be provided with advise and recommendations on soil condition and the crops suitable to be cultivated in that particular soil, methods for improving the soil health and package of practices to be followed during crop production. People engaged in commercial cultivation of any Agri-horti crops will be particularly benefitted through

this advisory. The scientific analysis In every two years, will enable them to assess the condition of their soil and do the necessary improvements.

In the later part this facility will also be used for manure and water testing, chemical analysis of fruits and vegetables etc.

Project requirements

- The soil testing labs need to be located in District headquarters.
- The labs can also be housed or attached to any Educational Institutions to draw advantage of the facilities and expertise available.
- Vocational course for students may also be taken up in such institutions on collection of soil samples, laboratory analytical methodologies, formulation of fertilizer schedules and maintenance of soil health.

Capacity of the Laboratory:

The laboratory has the capacity of testing around 350 samples per day. This way around 1,00,000 samples will be tested in a year. The target for testing of NPK only is 80% of the total sample and for micronutrients it will be 20 % of the total sample.

However the capacity utilization is considered at 40%, 60%, 75%, and 80% in the first four years and fifth year onwards it will continue to be 80%.

Equipment's:

The equipment's required for the laboratory are mentioned below.

Table 2: List of Equipments for Soil testing Laboratory

Name of Equipment	No.
Atomic Absorption Spectrophotometer (AAS) #	1
Kjeldahal unit for nitrogen distillation(Automatic)	1
Spectrophotometer #	1
Flame Photometer #	1
Conductivity Meter	1
pH Meter	1
Nephlometer for Sulphur estimation	1
Rotary Shaker Apparatus	1
Electronic Balance	1
Analytical Balance / Top Loading balance	2

Drying Ovens	2
Computer /Fax with appropriate software&Printer	1
Table Top Centrifuge	1
Gas and telephone connection	-
Glassware	
Chemicals	

These equipment's are used for determining pH, electrical conductivity, available Nitrogen, Phosphorus, Potassium, Organic Carbon, available sulphur besides calcium and magnesium content.

Transport:

As the Laboratory is static, there is need for collecting and transporting the soil samples to the facility. As the awareness about the facility gradually builds up in the nearby areas, the farmers would come to the laboratory with the soil samples by themselves for testing. The trainees of vocational course may be deputed and their services may be utilized for collection of representative soil samples as well as transfer of them to the nearest laboratory.

Raw Material

Apart from the collected soil samples, Chemicals and Glassware are required for undertaking the testing. These are available with leading scientific equipment and chemical manufacturers / suppliers.

Man power

One post graduate in agriculture with soil science specialization and adequate experience in soil analysis will be the Lead Analyst for the laboratory. He will be supported by two Lab Assistants (from soil science/ agriculture background) for preparation of samples and other laboratory works. For collection of samples and field related works, three persons are required.

4 Techno- Commercial Parameters

The Techno-economic Parameters for the Soil testing and Soil Health Counseling Facility are as follows:

1. A team of one specialist and two Semi-Skilled workers can analyze350 samples per day.
2. Analysis work will be done for six days in a week.
3. Sample collection and report writing etc will be done simultaneously.
4. Monthly approximately 8,750 samples will be analyzed and yearly 1,00,000 samples will be analyzed.

5. Sample collection will be done only eight months in a year depending upon cropping pattern. Analysis can be carried out throughout the year.
6. Capacity utilization will be 40%, 60%, 75% and 80% of the installed capacity in the first three years and 4th year onwards in that order.
7. Charges for testing would be ₹15/ per soil sample (for analysis of NPK) and ₹850/ per sample with micro-nutrients.
8. The chemicals and glassware consumption is considered@ ₹7 per sample for NPK analysis and @ ₹100/ per sample for micronutrient analysis.

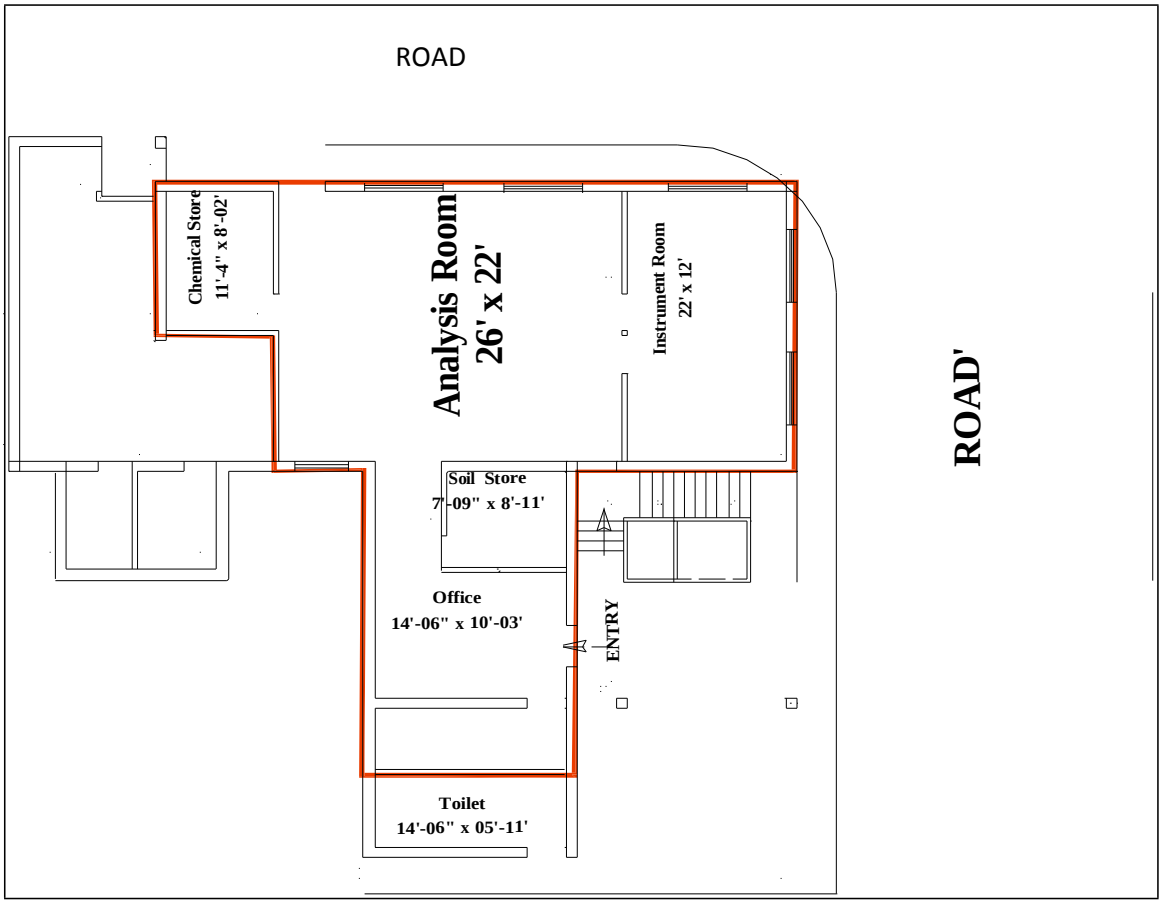

Figure 1: Layout for an ideal Soil Fertilizer Laboratory

5 Project financials

5.1 Project Cost

The project cost comprises of ₹ 53.65 lakh towards capital cost and ₹6.26 lakh for operational cost in the first year. The detailed operational cost has been furnished in Annexure II. The operational cost in the second, third and fourth year onwards is ₹11.00, ₹12.21 lakh and ₹12.61 lakh respectively.

Table 3: project cost:

PARTICULARS	Total
LAND	-
PLANT & MACHINERY	35.28
MISC. FIXED ASSETS	14.70
TOTAL FIXED ASSETS	**49.98**
NET CURRENT ASSETS	
WORKING CAPITAL	6.26
MARKET DEVELOPMENT EXPENSES	-
PRE-OPERATIVE EXPENSES	3.67
Total	**59.91**

Establishment of Soil Testing Laboratory and Soil Health Counselling Facility Cash flow Statement. Testing fee of ₹15/- per soil sample (excluding micro-nutrients) and ₹850/- per soil sample with micro- nutrients is considered in the model. The revenue in the first three years, and fourth year onwards would be ₹41.37, ₹62.06 , ₹77.57 and ₹82.74 lakh respectively.

Table 4: Cash flow statement

Sl No.	Item	Year 1	Year 2	Year 3	Year 4	Year 4 onwards
1	Capacity Utilization (%)	40	60	75	80	90%
Income from soil sample testing		40 % capacity	60 % capacity	75 % capacity	80 % capacity	90% capacity
2	Soil Test (NPK) (90 %)	5.67	8.51	10.63	11.34	12.76
	Soil Test (Micro Nutrient)10%	35.70	53.55	66.94	71.40	80.33
	Total	41.37	62.06	77.57	82.74	93.08
3	**Expenses incurred**	**24.69**	**30.33**	**33.36**	**34.29**	
4	Net Income	16.68	31.73	44.21	48.45	

5.2 Capital Costs for Establishment of Soil Testing Laboratory and Soil Test Lab

Table 5: Capital Cost

Sl.	Items	Cost (Rs. in lakhs)
1.	Equipment	28.6
2.	Chemicals :Glassware: Misc. laboratory articles	4.00
3.	Contingencies (Stationary: Literature printing and misc.)	2.00
4.	Standby Generator/Electricity source	4.00
	Total	38.6

Note: Subsidy would be provided @ 50% of project cost limited to maximum of Rs.15 lakh as one time subsidy.

Table 6: Cost of Equipments:

Name of Equipment	No.	Cost (Rs.in lakhs)
Atomic Absorption Spectrophotometer (AAS)	1	16.0
Kjeldahal unit for nitrogen distillation(Automatic)	1	4.00
Spectrophotometer	1	2.00
Flame Photometer	1	0.70
Conductivity Meter	1	0.50
pH Meter	1	0.30
Nephlometer for Sulphur estimation	1	0.25
Rotary Shaker Apparatus	1	0.40
Electronic Balance	1	0.70
Analytical Balance / Top Loading balance(@ 0.30 Lakh)	2	0.60
Drying Ovens	2	0.75
Computer /Fax with appropriate software&Printer	1	1.50
Table Top Centrifuge	1	0.25
Gas and telephone connection	-	0.15
Motorcycle	1	0.50
Total		**28.6**

Table 7: Indirect Expenses:

S.No.	Item	Year 1	Year 2	Year 3	Year 4 onwards
1.	Power, Water @ 5000 per month	60000	60000	60000	60000
2.	Manpower – Soil scientist @ ₹ 50,000/ pm and two Lab Technicians @ ₹15,000/ pm, Two Field Asst. @ ₹8,000/pm, Four LabAsst@ ₹8,000/pm, Two Security @ ₹8,000/pm,	**@ ₹ 1,28,000/m 15,36,000**	**@ ₹ 1,44,000/m 17,28,000**	**@ ₹ 1,44,000/m 17,28,000**	**@ ₹ 1,44,000/m 17,28,000**
3.	Expenditure on Chemical and Glassware @ ₹50/ per sample	7,43,000	11,15,000	13,94,000	14,87,000
4.	L.P.G ₹1000/ per month	12000	12000	24000	24000
5.	Repair & maintenance	10,000	10,000	10,000	10,000
6.	Telephone @ ₹1000 per month	12000	12000	24000	24000
7.	Travel for canvassing and collection of samples @ ₹8000 per month	96,000	96,000	96,000	96,000
8.	**Total**	**24,69,000**	**30,33,000**	**33,36,000**	**34,29,000**
9.	With Annual escalation @ 10 %				

Margin Money

The margin money / down payment considered in the model is 15 % of the unit cost which works out to ₹8,98,650.

Bank Loan

Bank loan of 85 - 95 % of the total cost shall be available from the financing institution. Bank loan considered in the model is 85%. It works out to ₹ 44.93 lakh in the model.

Rate of interest

Banks are free to decide the rate of interest within the overall RBI guidelines issued from time to time. However, the ultimate lending rate has been considered as 12 % for working out the bankability of the model project.

Security

Banks are guided by RBI guidelines issued from time to time in this regard.

5.3 Financial analysis

The techno economic parameters assumed in the model are given in Annexure III. The cash flow statement and detailed financial analysis are shown in Annexures I & IIV respectively. The financial analysis indicates that the scheme is viable. The major financial indicators are given below:

Table 8: Financial indicators:

KEY INDICATORS	Envisaged As per 5th Year
NET PROFIT AFTER TAX	28.20
INTERNAL RATE OF RETURN	27.67%
BREAK EVEN POINT(% of total sale)	52.52
PAY BACK PERIOD (YEARS)	4.28

5.4 Repayment schedule

Based on the cash flow the detailed repayment schedule has been worked out and furnished below. The repayment period works out to 7 years.

Table 9: Loan Repayment Schedule

Loan Repayment Schedule	
Particular	**Amount**
Loan Amount	**44.93**
Interest Rate	**14%**
Duration	**7**
Instalment	**6.42**

Year	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Principle		44.93	41.72	35.30	28.88	22.47	16.05	9.63	3.21
Installment 1			3.21	3.21	3.21	3.21	3.21	3.21	3.21
Installment 2		3.21	3.21	3.21	3.21	3.21	3.21	3.21	
Total Installement		3.21	6.42	6.42	6.42	6.42	6.42	6.42	3.21
Intrest 1		3.15	2.92	2.47	2.02	1.57	1.12	0.67	0.22
Intrest 2		3.15	2.70	2.25	1.80	1.35	0.90	0.45	(0.00)
Total Interest	3.15	6.29	5.62	4.72	3.82	2.92	2.02	1.12	0.22
Principle Paid		3.21	6.42	6.42	6.42	6.42	6.42	6.42	3.21
Balance		41.72	35.30	28.88	22.47	16.05	9.63	3.21	(0.00)

ANNEXURE -I

Cash Flow Statement (RS IN LACS)

PARTICULARS	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
SOURCES											
INCREASE IN SHARE CAPITAL	14.98	-	-	-	-	-	-	-			
NET PROFIT	-	(13.58)	3.68	15.67	20.16	20.65	19.26	19.59	19.88	20.12	20.32
(INTEREST ADDED BACK)											
SUBSIDY	-										
DEPRECIATION	-	7.50	6.37	5.42	4.60	3.91	3.33	2.83	2.40	2.04	1.74
PRELIMINARY EXP.W/O	-	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
INCREASE IN TERM LOAN	44.93	-	-	-	-	-	-	-			
INCREASE IN WC	-	-	-	-	-	-	-	-			
	59.91	**(5.72)**	**10.42**	**21.45**	**25.13**	**24.93**	**22.96**	**22.79**	**22.65**	**22.53**	**22.43**

Annexure II

DISCOUNTED CASHFLOW STATEMENT

PARTICULARS	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
CAPITAL COST			-								
GROSS REVENUE		41.37	62.06	77.57	82.74	93.08	93.08	93.08	93.08	93.08	93.08
PROD & OTHER COSTS		47.09	51.63	56.12	57.61	60.60	60.60	60.60	60.60	60.60	60.60
SURPLUS	-	(5.72)	10.42	21.45	25.13	32.48	32.48	32.48	32.48	32.48	32.48
SALVAGE VALUE											3.11
GROSS SURPLUS		(5.72)	10.42	21.45	25.13	32.48	32.48	32.48	32.48	32.48	35.59
DF @5%		0.95	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50
PW	-	(5.43)	9.38	18.23	20.10	24.36	22.73	21.11	19.49	17.86	16.24
DF		0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	0.00
PW	-	(5.15)	8.34	15.02	15.08	16.24	12.99	9.74	6.50	3.25	0.00
IRR				**(17.79)**		**7.05**	**12.80**	**27.67%**			