

B. Sc. (Hons) Agriculture

Soil Science and Agricultural Chemistry

- **Syllabus**
- **Teaching Schedule**
- **Suggested Readings**

Soil Science and Agril. Chemistry

Sr. No.	Semester	Course No.	Credits	Course Title
1	I	SSAC 111	3(2+1)	Fundamentals of Soil Science
2	IV	SSAC 242	2(1+1)	Problematic Soils and their Management
3	V	SSAC 353	3(2+1)	Manures, Fertilizers and Soil Fertility Management
4	VI	ELE SSAC 364	3(2+1)	Agrochemicals
5	VIII	ELM SSAC 485	10(0+10)	Soil, Water, Plant and Fertilizer Analysis
6	VIII	ELM SSAC 486	10(0+10)	Agricultural Waste Management

Course :	SSAC 111		Credit:	3(2+1)	Semester-I
Course title:	Fundamentals of Soil Science				

Syllabus

Theory

Soil as a natural body, pedological and edaphological concepts of soil. Soil genesis: soil forming rocks and minerals. Weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; Soil air, composition, gaseous exchange, problem and plant growth, Soil temperature; source, amount and flow of heat in soil; effect on plant growth, Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge; ion exchange, cation exchange capacity, base saturation; soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: macro and micro organisms, their beneficial and harmful effects; Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

Practical

Study of soil profile in field. Study of soil sampling tools, collection of representative soil sample, its processing and storage. Study of soil forming rocks and minerals. Determination of soil density, moisture content and porosity. Determination of soil texture by feel and Bouyoucos Methods. Studies of capillary rise phenomenon of water in soil column and water movement in soil. Determination of soil pH and electrical conductivity. Determination of cation exchange capacity of soil. Study of soil map. Determination of soil colour. Demonstration of heat transfer in soil. Estimation of organic matter content of soil.

Teaching schedule

a) Theory

Lecture	Topic	Weightage (%)
1 & 2	History and development of soil science, its scope and importance. Soil as natural body, pedological and edaphological concept of soil.	5
3 & 4	Soil genesis: Soil forming rocks and minerals.	6
5 & 6	Weathering of Rocks and Minerals.	6
7 & 8	Processes and factors of soils formation.	5
9	Soil profile, components of soil.	5
10 & 11	Soil physical properties: Soil texture, structure, density and porosity.	5
12	Soil colour, consistency and plasticity.	3
13, 14	Elementary knowledge of soil survey, soil taxonomy, classification, Land capability classification.	5
15	Soils of India and Maharashtra.	3
16, 17 & 18	Soil water : Soil water classification, soil water retention , soil water potential, soil moisture constants', Hydraulic conductivity, permeability, percolation, movement and availability in soil.	6
19	Soil air : composition, gaseous exchange and effect on plant growth.	6
20	Soil temperature: source, amount and flow of heat in soil and effect on plant growth.	6
21 & 22	Soil reaction: pH, soil acidity and alkalinity, buffering capacity, effect of soil pH on nutrient availability.	6
23 & 24	Soil colloids: soil colloidal properties, inorganic and organic colloids.	4
25, 26 & 27	Silicate clay: constituents and properties, sources of charge, ion exchange, cation and anion exchange capacity, base saturation.	6
28, 29 & 30	Soil organic matter: sources, composition, properties, factors affecting SOM, its importance and influence on soil properties.	6
31	Humic substances-nature and properties	5
32, 33 & 34	Soil organisms : macro and micro organism, their beneficial and harmful effects on soil and plant. soil biological properties (SMBC, soil respiration, DHA etc.)	6
35 & 36	Soil pollution – sources of soil pollution*, behavior of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.	6
	Total	100

b) Practical

Experiment	Topic
1	Study of soil forming minerals.
2	Study of soil forming rocks.
3	Study of soil sampling tools, collection of representative soil sample, its processing and storage.
4	Determination of moisture content in soil by gravimetric method.
5	Determination of soil colour by Munsell soil colour chart in field.
6	Determination of bulk density (Clod coating method) and particle density by pycnometer and porosity of soil.
7	Determination of soil texture by feel method.
8	Determination of soil texture by Bouyoucos hydrometer method.
9	Demonstration of capillary rise phenomenon of water in soil column.
10	Determination of infiltration rate of soil by double ring infiltrometer.
11	Determination of hydraulic conductivity of soil by constant head method.
12	Determination of soil temperature by using soil thermometer (0-15 and 15-30cm).
13	Determination of soil pH and electrical conductivity of soil.
14	Determination of anion exchange capacity of soil.
15	Determination of cation exchange capacity of soil (By NH_4OAc Method).
15	Study of soil map.
16	Estimation of organic carbon and organic matter content in soil by Walkely and Black method.
17 & 18	Study of soil profile in field.

Suggested Reading

- 1) ISSS. 2009. Fundamentals of Soil Science. 2nd Ed. Indian Society of Soil Science, New Delhi- 110 012. pp. 728.
- 2) Das D. K. 2011. Introductory Soil Science, 3rd revised and Enlarged Ed, Kalyani Publisher, Ludhiana. pp. 645.
- 3) Brady, N. C. 2016. The Nature and Properties of Soils. 15th edition Publisher: Pearson Education, ISBN: 978-0133254488
- 4) Daji J A; Daji J A; Kadam J R; Patil N D.1996. Textbook of Soil Science Bombay Media Promoters and publishers Pvt. Ltd.
- 5) **Biswas, T.D.; Mukherjee, S.K..** 1995. Text Book of Soil Science 2nd sEd.Tata McGraw Hill Publisher, Delhi pp 433.
- 6) 6. Somawanshi, et al. 2012. Laboratory Methods for Analysis of Soil, Irrigation Water and Plants..., Department of Soil Science and Agricultural Chemistry, MPKV., Rahuri. revised Ed. pp. 307.
- 7) Jakson, M.L. 1973. Soil Chemical Analysis. Printice Hall, India, Pvt. Ltd. New Delhi. pp 498.
- 8) Page et. al. 1982. Methods of Soil Analysis, Part 1 and 2. Chemical and Microbiological Properties . 2nd Ed. Soil Science Soc. of America Am. Soc. Agron., Madison, Wisconsin, USA.
- 9) Klute, A. 1986. Methods of Chemical Analysis, 2nd Ed. American Soc. Agron.,Inc. and Soil Science Society of America. Madison, Wisconsin, USA.
- 10) Piper, C. S. 1966. Soil and Plant Analysis. Inters Science . Hans Publisher, Mumbai.
- 11) Black, C. A. 1965. Soil Chemical Analysis, Part I and part II. American Soc. Agron.,Inc. and Soil Science Society of America. Madison, Wisconsin, USA.
- 12) Hesse, P. R. 1971. a Text Book of Soil Chemical Analysis. John Murray, London.
- 13) Richards, L. A. 1968. Diagnosis and Improvement sof Saline Alkali Soils. Oxford andIBH Publication Co. Calcutta.
- 14) Chora, S. L. and Kanwar, J. S. 1991. Analytical Agricultural Chemistry, Kalyani Publisher New Delhi.
- 15) *Chapman, H.D., and P.F. Pratt. 1961. Methods of analysis for soils, plants and waters. Division of Agricultural Sciences, University of California,*
- 16) Mehara , R. K. 2004. Text Book of Soil Science., ICAR, New Delhi.
- 17) Patil, V. D. and Mali C. V. 2007. Fundamentals of Soil Science, Aman Publication, Meerut.
- 18) NirankariLal Singh. 2000. Text Book of Soil Science. Aman Publication, Meerut.
- 19) Dahama , A. K. Organic farming for sustainable agriculture. 19, AgrobotanicaBinaker. Pp 53-98 and 210-255.
- 20) Tandon H.L.S. 1994. Recycling of Waste in Agriculture. Fertilizer Development t and consultation organization.

Course :	SSAC 242		Credit:	2(1+1)	Semester-IV
Course title:	Problematic Soils and their Management				

Syllabus

Theory

Soil quality and health, Distribution of Waste land and problem soils in India. Their categorization based on properties. Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils. Irrigation water – quality and standards, utilization of saline water in agriculture. Remote sensing and GIS in diagnosis and management of problem soils. Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-ecosystems.

Practical

Saturation paste extract, its analysis for pHe and ECe, soluble cations and anions, competition of SAR and RSC. Exchangeable sodium percentages of soil, gypsum requirement of sodic soil, lime requirement of acidic soils. Irrigation water sampling technique, sewage water. Determination of pH, EC, soluble cations and anions. Computation of RSC and SAR, BOD and COD of sewage water, Satellite image analysis of salt affected soils

Teaching schedule

a) Theory

Lecture	Topic	Weightage (%)
1-2	Soil degradation: Concept, types, factors and processes. Soil quality and soil health: definition and concept, soil quality indicators. Characteristics of healthy soils.	6
3-4	Distribution and extent of waste land and problematic soils in India and Maharashtra. Categorization of problem soils based on properties.	6
5-6	Saline soils, alkali Soils, saline-alkali soils, degraded alkali soils, coastal saline soils: definition, formation, characteristics, effect on plant growth, reclamation and management. Acid and acid sulphate soils: definition, formation, characteristics, effect on plant growth, reclamation and management.	12
7-8	Calcareous Soil: definition, formation, characteristics, effect on plant growth, reclamation and management.	8
9	Eroded soils and compacted soils: definition, formation, characteristics, effect on plant growth, reclamation and management.	6

Lecture	Topic	Weightage (%)
10	Submerged soils and flooded soils: definition, formation, characteristics, effect on plant growth, reclamation and management.	10
11	Polluted soils: definition, sources and their remediation.	10
12	Water pollution: definition, sources and their remediation.	6
13	Quality of Irrigation water and its suitability for irrigation.	6
14	Utilization of saline and sewage water in Agriculture.	6
15	Remote sensing and GIS in diagnosis and management of problem soils.	6
16	Multipurpose tree species and bioremediation of soils.	6
17	Land capability classification and Land suitability classification.	6
18	Problematic soils under different Agro-ecosystem.	6
	Total	100

b) Practical

Experiment	Topic
1 & 2	Preparation of saturation paste extract.
3	Determination of pH_e and EC_e .
4 & 5	Determination of cations (Ca, Mg, Na and K) and computation of SAR.
6 & 7	Determination of ESP of soils.
8	Determination of gypsum requirement of sodic soil.
9	Determination of calcium carbonate from soil.
10	Determination of lime requirement of acidic soil.
11	Collection of irrigation water and sewage water.
12	Determination pH and EC from irrigation water.
13 & 14	Determination of cations (Ca, Mg, Na and K) from irrigation water.
15 & 16	Determination of anions (CO_3 , HCO_3 , Cl and SO_4) from irrigation water and RSC and SAR.
17	Determination of BOD and COD.
18	Satellite image analysis by visual method.

Suggested Reading

- 1) Richards L. A.. 1954. Diagnosis and Improvement of Saline and Alkali Soils. United State Department of Agriculture.
- 2) Maliwal, G. La. and Somani L.L. 2010. Nature Properties and Management of Sine and Alkali Soils. Agrotech Publishing Academy, Udaipur 313 002. pp. 335.

- 3) Mahendran , et al. Soil Resource Inventory and Management of Problematic [i.e. Problematic] Soils. Published by Agrotech Publishing Academy (2012) ISBN 10: 818321097X / ISBN 13: 9788183210973
- 4) Abrol, I. P., Yadav, J. S. P and Massoud, F. I. 1988. Salt-Affected Soils and their Management. FAO SOILS BULLETIN 39. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, Rome, 1988.
- 5) Tyagi, N.K. and P.S. Minhas. 1998. Agricultural Salinity Management in India Published by CSRI.,Kernal. (Price Rs. 500/-).
- 6) Yaduvanshi, N. P. S. 2008. Chemical Changes and Nutrient Transformation in Sodic/Poor Quality water Irrigated Soils . Published by CSRI.,Kernal.
- 7) Dey, P. , Gupta, S. K. 2012. Diagnostics, Remediation and Management of Poor Quality Waters: Lectures for Summer School by R. L. Meena, S. K. Gupta, R. K. Yadav and D. K. Sharma, 2011. Salinity Management for Sustainable Agriculture in Canal Commands. Published by CSRI.,Kernal.
- 8) Twenty five years of research on management of salt affected soils & use of saline water in agriculture, 1998 (Price Rs. 75/-). Published by CSRI.,Kernal.
- 9) Patil, V. D. and Mali C. V. 2007. Fundamentals of Soil Science, Aman Publication, Meerut.
- 10) Das, D. K. Introductory Soil Science
- 11) Brady, N. C. 2016. The Nature and Properties of Soils. 15th edition Publisher: Pearson Education, ISBN: 978-0133254488.
- 12) The chemistry of Soil – Firman Bear
- 13) Text Book of Pedology Concepts and Applications – J. Sehgal
- 14) FAO United Nations Soils Portal- FAO

Course :	SSAC 353		Credit:	3(2+1)	Semester-V
Course title:	Manures, Fertilizers and Soil Fertility Management				

Syllabus

Theory

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management. Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order. History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

Practical

Introduction of analytical instruments and their principles, calibration and applications, Colorimetry and flame photometry. Estimation of soil organic carbon, Estimation of alkaline hydrolysable N in soils. Estimation of soil extractable P in soils. Estimation of exchangeable K; Ca and Mg in soils . Estimation of soil extractable S in soils.. Estimation of DTPA extractable Zn in soils. Estimation of N in plants. Estimation of P in plants. Estimation of K in plants. Estimation of S in plants.

Teaching schedule

a) Theory

Lesson	Topic	Weightage (%)
1 & 2	History of soil fertility and plant nutrition.	3
3 & 4	Soil as a source of plant nutrients, essential and beneficial nutrients and their role. Criteria of essentiality, forms of nutrients in soil.	5
5, & 6	Introduction and importance of organic manures. Sources of organic matter, recycling, composition and C:N ratio.	5
7, 8 & 9	Definition, properties and classification of bulky and concentrated organic manures, their composition and nutrient availability. Preparation of FYM, composts, different methods of composting, decomposition process and nutrient losses during handling and storage.	6

Lesson	Topic	Weightage (%)
10 & 11	Vermicomposting, green manuring; types, advantages and disadvantages and nutrient availability.	5
12 & 13	Sewage and sludge, Biogas plant slurry; their composition and effect on soil and plant growth.	5
14 & 15	Integrated nutrient management; concept, components and importance.	6
16 & 17	Fertilizer; Definition and their classification; N fertilizers: classification, manufacturing process and properties their fate and reaction in soils.	6
18 & 19	Phosphatic fertilizers, manufacturing process and properties, classification, their fate and reaction in soils.	5
20 & 21	Potassic fertilizers: classification, manufacturing process, properties, their fate and reaction in soils. Complex fertilizers their fate and reaction in the soil. Nano fertilizers.	5
22 & 23	Secondary & micronutrient fertilizers: Types, composition, reaction in soil and effect on crop growth. Soil amendments.	5
24	Handling and storage of fertilizers: Fertilizer control order.	3
25 & 26	Mechanism of nutrient transport to plants: Factors affecting nutrient availability to plants. Measures to overcome deficiencies and toxicities.	6
27,28 & 29,	Chemistry of soil N,P, K, calcium, magnesium, sulphur and micronutrients.	6
30 & 31	Soil fertility evaluation and different approaches.	6
32	Soil Testing (Available nutrients) :Chemical methods and critical levels of different nutrients in soil.	6
33	Plant analysis methods : Critical levels of nutrients, DRIS approach, rapid tissue test, indicator plants. Soil test based fertilizer recommendations to crops.	6
34 & 35	Methods and scheduling of nutrient applications for different soils and crops grown under rain fed and irrigated conditions.	6
36	Factors influencing nutrients use efficiency (NUE) in respect of N, P, K, S, Fe and Zn fertilizers.	5
Total		100

b) Practical

Experiment	Topic
1	Principle and application of spectro-photometry / Colorimetry .
2	Principle and application of flame photometry and atomic absorption spectrophotometer (AAS).
3	Determination of moisture from organic manures and its preparation for nutrient analysis.
4	Determination of organic carbon from organic manures by ignition method.
5	Estimation of available nitrogen in soil (Alkaline permanganate method)
6	Estimation of available phosphorus in soil.
7	Determination of available potassium in soil using flame photometer.
8	Determination of exchangeable Ca& Mg in soil by EDTA method.
9	Estimation of available sulphur in soil (Turbidity method).
10	Estimation of DTPA extractable micronutrients from soil using AAS.
11	Estimation of total N from plant sample by Micro Kjeldahl's method.
12	Plant analysis for P,K, secondary and micronutrients.
13	Fertilizer adulteration test / identification of adulteration in fertilizer / Detection of adulteration in fertilizers (Rapid test).
14	Determination of nitrate nitrogen content of potassium nitrate.
15	Determination of water soluble phosphorus in superphosphate (Pumberton method).
16	Determination of acid soluble phosphorus from rock phosphate.
17	Determination of total potassium content of muriate of potash (flame photometer).
18	Determination of zinc content from micronutrient fertilizer (EDTA Method).

Suggested Reading

- 1) Mariakulandi and Manickam: 1975 : Chemistry of fertilizers and manures.
- 2) Mariakulandi and Manickam (1975) : Chemistry of manures and fertilizers
- 3) Tandon H. L. S. (1994) : Recycling of crop, animal, human and industrial Wastes in Agriculture. FDCO, Delhi
- 4) Krishna and Murthy (1978) : Manual on compost and other organic manures .
- 5) Rakshit A. 2015. Manures Fertilizers and Pesticides Paperback – Import. CBS Publishing; 1ST edition, pp. 266.

- 6) Zhongqi Heand Hailin Zhang) . 2016 . Applied Manure and Nutrient Chemistry for Sustainable Agriculture and Environment Paperback – Import. Springer. pp. 379.
- 7) Havlin , John L, Samuel L. Tisdale (Author), Werner L. Nelson (Author), James D. Beaton (2004).Soil Fertility and Fertilizers (8th Edition) 8th Edition. Published July 23rd 2004 by Prentice Hall. pp. 528.
- 8) Havlin , John L. 2004. Soil Fertility and Fertilizers: An Introduction to Nutrient Management Published July 23rd 2004 by Prentice Hall. pp. 528.
- 9) James F. Power, Rajendra Prasad. 1997 .Soil Fertility Management for Sustainable Agriculture. CRC Press Tayloer and Francis Group. .Textbook -pp. 384 .ISBN 9781566702546
- 10) ISSS. 2009. Fundamentals of Soil Science. 2nd Ed. Indian Society of Soil Science, New Delhi- 110 012. pp. 728.
- 11) Das D. K. 2011. Introductory Soil Science, 3rd revised and Enlarged Ed, Kalyani Publisher, Ludhiana. pp. 645.
- 12) ICAR Handbook of manures and fertilizers (1971) publication.
- 13) Yawalkar K.S. Manures & fertilizer: (1992).
- 14) Somawanshi, et al. 2012. Laboratory Methods for Analysis of Soil, Irrigation Water and Plants..., Department of Soil Science and Agricultural Chemistry, MPKV., Rahuri. revised Ed. pp. 307.
- 15) Jakson, M.L. 1973. Soil Chemical Analysis. Printice Hall, India, Pvt. Ltd. New Delhi. pp 498.
- 16) Page et. al. 1982. Methods of Soil Analysis, Part 1 and 2. Chemical and Microbiological Properties . 2nd Ed. Soil Science Soc. of America Am. Soc. Agron., Madison, Wisconsin, USA.
- 17) *Chapman, H.D., and P.F. Pratt. 1961. Methods of analysis for soils, plants and waters. Division of Agricultural Sciences, University of California.*
- 18) Brady, N. C. 2016. The Nature and Properties of Soils. 15th edition Publisher: Pearson Education, ISBN: 978-0133254488.
- 19) ISSS. 2009. Fundamentals of Soil Science. 2nd Ed. Indian Society of Soil Science, New Delhi- 110 012. pp. 728.
- 20) Das, D. K. 2011. Introductory Soil Science, 3rd revised and Enlarged Ed, Kalyani Publisher, Ludhiana. pp. 645.
- 21) Tisdale, S. L. and Nelson, W. L. and Beaqton, J. D. 2010. Soil Fertility and fertilizers. 7th Ed. Macmillan Publishing Company, 445 Hutchinson Avenue, Columbus.
- 22) Yawalkar, K. S. ,Agarwal, J. P. and Bokde, S. 1967. Manures and Fertilizers. Agri-Horticultural Publication.
- 23) Chopra, S. L. and Kanwar, S. L. and Rakshit, J. S. 2014. Analytical Agricultural Chemistry. Kalyani Publisher.
- 24) Hand book of fertilizers use (1980) : FAI publication

Course :	ELE SSAC 364		Credit:	3(2+1)	Semester-VI
Course title:	Agrochemicals				

Syllabus

Theory

An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture. Herbicides - Major classes, properties and important herbicides. Fate of herbicides. Fungicides - Classification - Inorganic fungicides - characteristics, preparation and use of sulfur and copper, Mode of action - Bordeaux mixture and copper oxychloride. Organic fungicides - Mode of action - Dithiocarbamates - characteristics, preparation and use of Zineb and maneb. Systemic fungicides - Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use. Introduction and classification of insecticides: inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant. IGRs Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses. Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate. Mixed and complex fertilizers: Sources and compatibility - preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing. Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

Practical

Sampling of fertilizers and pesticides. Pesticides application technology to study about various pesticides appliances. Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer. Calculation of doses of insecticides to be used. To study and identify various formulations of insecticide available in market. Estimation of nitrogen in Urea. Estimation of water soluble P_2O_5 and citrate soluble P_2O_5 in single super phosphate. Estimation of potassium in Muriate of Potash/ Sulphate of Potash by flame photometer. Determination of copper content in copper oxychloride. Determination of sulphur content in sulphur fungicide. Determination of thiram. Determination of ziram content.

Teaching schedule

a) Theory

Lesson	Topic	Weightage (%)
1	Introduction to agrochemicals, their type and role in agriculture,	2
2	Effect of agrochemicals on environment, soil, human and animal health. Merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture.	4
3	Fertilizers and their classification;	3
4 & 5	N fertilizers : classification, manufacturing process and properties, their fate and reaction	4
6 & 7	Phosphatic fertilizers, manufacturing process and properties	4
8	Potassic fertilizers and complex fertilizers, their fate and reaction in soils.	3
9 & 10	Secondary nutrients and fertilizers, their type, composition, reaction in soils and effect on crop growth.	4
11	Micronutrient fertilizers, their type, composition, reaction in soils and effect on crop growth.	4
12	Liquid fertilizers	3
13	Handling and storage of fertilizers	3
14	Biofertilizers and their role in crop production	4
15	Fertilizer control order and insecticide Act	2
16	Introduction and classification of insecticides: Different types of Classification of insecticides. (Based on toxicity, mode of entry, mode of action, chemical nature)	4
17 & 18	Inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals.	5
19	Insecticide Act and rules. Insecticides banned, withdrawn and restricted use,	2
20	IGRs and Biopesticides. Reduced risk insecticides	2
21	Botanicals, plant and animal systemic insecticides their characteristics and uses.	3
22	Mode of action of insecticides (Pyrethroids, organophosphates, Carbamates and Chitin synthesis inhibitor)	4
23	Fate of insecticides in soil & plant.	3

Lesson	Topic	Weightage (%)
24	Insecticide resistance and its management	3
25	Pesticide residue- Definition, steps involved in determination of residue.	3
26 & 27	Copper fungicides, formulation of Bordeaux mixture and Bordeaux paste. Chemical reaction involved merits and demerits of Bordeaux mixture. Mode of action of copper fungicides	5
28	Sulfur fungicides: Organic and inorganic sulfur fungicides their classification and mode of action. Preparation of lime sulfur mixture and chemical reaction involved.	4
29	Benzimidazole fungicides, their chemical nature, mode of action and their use	3
30	Introduction to new generation fungicides. Viz Metalaxyl, fosetyl Al, Triazoles and shawbilirin fungicides	4
31	Herbicide- Classification, Formulations, Methods of application.	3
32	Mode of action of herbicide- Translocation and absorption	3
33	Persistence and fate of herbicides, Residual effect of herbicides	3
34	Introduction to selectivity of herbicide	2
35	Compatibility of herbicides with other Agrochemicals	2
36	Introduction to adjuvants and their use in herbicides	2
	Total	100

b) Practical

Experiment	Topic
1	Fertilizer Adulteration test / Identification of Adulteration in fertilizer / Detection of adulteration in fertilizers (Rapid test)
2	Determination of (Amide nitrogen) from urea.
3	Determination of ammoniacal nitrogen content and nitrate nitrogen content from nitrogenous fertilizer
4	Determination of water soluble phosphorus in superphosphate (Pumberton method)
5	Determination of acid soluble phosphorus from rock phosphate
6	Determination of total potassium content of muriate of potash (by flame photometer).

Experiment	Topic
7	Determination of sulphur content from fertilizer (Gravimetric Method)
8	Determination of Zinc content from micronutrient fertilizer (EDTA Method)
9	Study of plant protection appliances
10	Calculation of doses of insecticides
11	Study of formulations of pesticides
12	Study of pesticide application techniques.
13	Herbicide label information and computation of herbicide doses.
14	Equipments used for herbicide application and calibration. Demonstration of methods of herbicide application.
15	Study of phytotoxicity symptoms of herbicides in different crops.
16	Handling and storage of fungicides and Agrochemicals
17	Preparation of Bordeaux mixture and Bordeaux paste and fungicides solutions.
18	Methods of application of fungicides.

Suggested Reading

- 1) Manures and fertilizers – Yavalkar, Agarwal and Bokde
- 2) Chemistry of fertilizers and manures – Mariakulandi and Manickam
- 3) Nature and properties of soil – N.C. Brady
- 4) Organic manures – Gour, (ICAR publication)
- 5) Recycling of crop, animal, human and industrial waste in Agriculture – H.L.S. Tondon
- 6) Handbook of manures and fertilizers – ICAR publication
- 7) Text book of soil science – Biswas and Mukharjee
- 8) Fundamentals of soil science – ISSS publication
- 9) Text Book of fertilizers – RanjankumarBasak
- 10) Fertilizer Guide – Tondon HLS (1994)
- 11) Handbook on fertilizer usage – Seetharam S, Priswas, BC, Yadav DS, Matneswaru S. (1996)
- 12) Fertilizer control order (1985) The fertilizer Association of India
- 13) The Pesticide manual A world compendium (1995) – British crop production council, UK
- 14) Outline of organic chemistry: Bahl and Tuli
- 15) Chemistry of insecticide: SreeRamulu US (1991)
- 16) Fungicide in plant disease control: Nene YL and Thapliyal
- 17) Principles of weed science: Rao VS (1992)