

Message from the President



Economy of a Country is dependent on the 'Quality' of Education. What is quality? It is to meet the predetermined requirements to the satisfaction of the users for a particular substance or a

service. Education is a service. Users are the employers who employ the trained students. What are the predetermined requirements that an employer (mainly industry) expect from a student who has the training in the subject of Chemistry such that the trained student possesses the, (i) Ability to understand the organization process and the (ii) Ability to apply fundamental principles of Chemistry whenever a need arises in the industry. Economy is dependent on the availability of knowledge based industries which are responsible for the value addition to the resources of a country. The economy will progress if the employable human resources possess the above capabilities (Principles of chemistry → Technology → To fulfill the technological needs of a country → Development of Knowledge Economy). The application of the principles of science to technology becomes fruitful if there is a scientific culture in a country where Education in Science and Technology plays a vital role.

The concept of 'sustainability', implies meeting human needs while preserving the environment and natural resources needed by future generations. The Technology can be considered as the output of scientific theories giving the final product needed for economic growth. An industry utilizes a technology or several technologies in its manufacturing stages. Any form of technology cannot survive without science. Technology may flourish for sometimes but ultimately die off if it is not supported by the science. The survival of a particular technology is dependent on the applications of the associated sciences required to improve the existing technology(ies) such a way that

the manufactured product(s) will meet the present challenges in the market. i.e. 'Quality'. One could argue that ancient Sri Lanka had only the technology, which helped in the booming of the economy from time to time with the assistance of good governance. It is clear that the ancient technology was based on some form of unwritten science surely not the modern science. Due to historical reasons most of the ancient unwritten sciences died off leaving us to apply the 'modern science' to ancient as well as modern technology. Therefore, the application of modern science to technology is essential since the sustainable development of a country is based on the improvement of the technologies.

In order to achieve the National Goals the curriculum at G.C.E. (A/L) should cater for 90% of the students who do not gain admission to Universities in Sri Lanka. The fundamental principles in chemistry should be taught thoroughly with at least one application of each principle. The evaluation should be based on testing the ability of the student to apply the principle to different situation which has not been taught. The credit given at examination should be merit of the competency to use the knowledge and not the ability to memorize the learnt materials. This is a difficult task for the examiners. However, it helps in the development of the economy of the country.

Teaching of scientific principles as applied to day to day life, laboratory and environment and EVALUATION geared towards the testing of the ability to use the knowledge when the need arises will undoubtedly fulfill the above needs. Does the traditional Science Education in Sri Lanka provide the TRAINING to use the knowledge when the need arises? It mainly provides students to imagine the so called SCIENCE in TEXT BOOKS. There are several examples where the knowledge is confined to text books and not to the applications to lab or day to day life. As a professional body, it is very essential that the Institute of Chemistry Ceylon takes adequate measures to influence all educational institutions of Sri Lanka including its College of Chemical Sciences to produce students of QUALITY.

Professor HD Gunawardhana
President, Institute of Chemistry Ceylon

Role of Chemistry in Sustainable Agriculture

Dr S Mohanadas

Immediate Past President, Institute of Chemistry Ceylon

Sustainable agriculture means in short is a prerequisite for sustainable human inhabitation on this planet earth. Agriculture is not only essential for food, clothing and shelter but also for healthcare, recreation and education as well. Sustainable agriculture brings employment opportunities, economic growth, national development and prosperity to the country. Chemistry is closely connected with the sustainable agriculture and in turn to the prosperity of Sri Lanka.

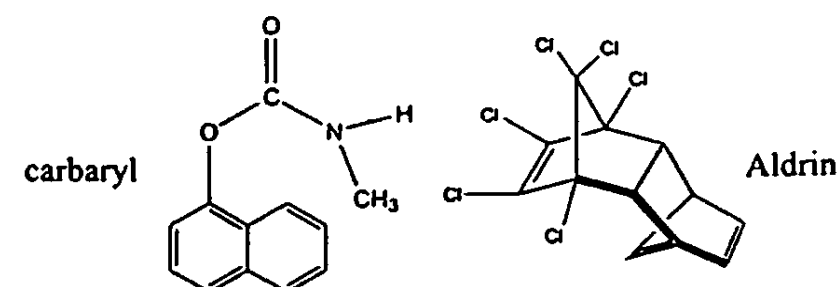
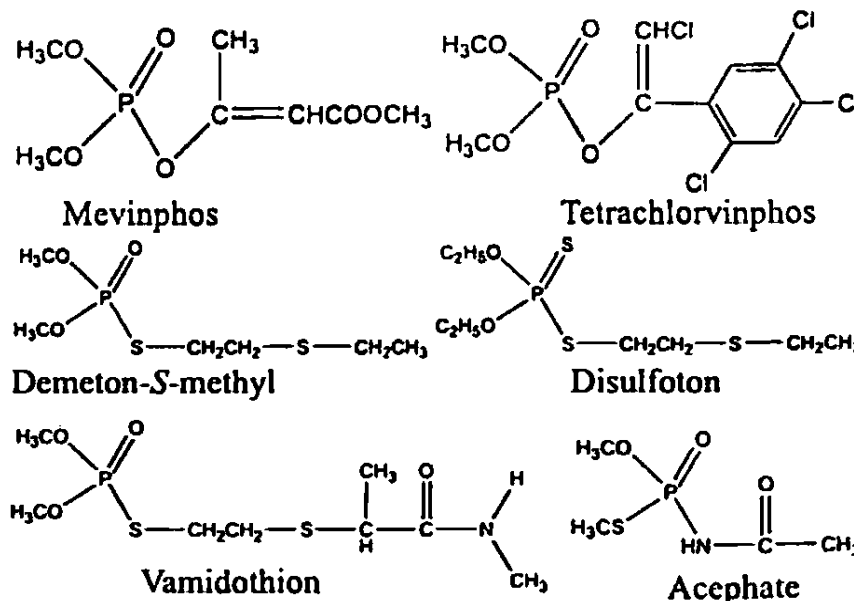
"The Role of Chemistry in Sustainable Agriculture" was the theme of the 42nd Annual Sessions of the Institute of Chemistry Ceylon and it was a common forum for all chemists, agronomists, food technologists, environmentalists and other scientists to discuss, update and share their knowledge and experiences on subject related to chemistry and agriculture. Chemistry plays a major role in sustainable agriculture in many ways such as chemistry on plantation crops, soil, agrochemicals, hazardous chemicals in agriculture and its impact on human health and agriculture for greater economic growth.

In Sri Lanka the chemistry education is starting from schools and continues to universities in both undergraduate and postgraduate levels at a very high standard. The Institute of Chemistry Ceylon has been imparting knowledge on chemical education in this country over three decades at various levels such as certificate, diploma in laboratory technician and graduate chemists. This high quality chemical education has led to good research output in many research institutes, government departments and universities in Sri Lanka. These research findings have been very useful to farmers, industrialists, entrepreneurs and policy planners.

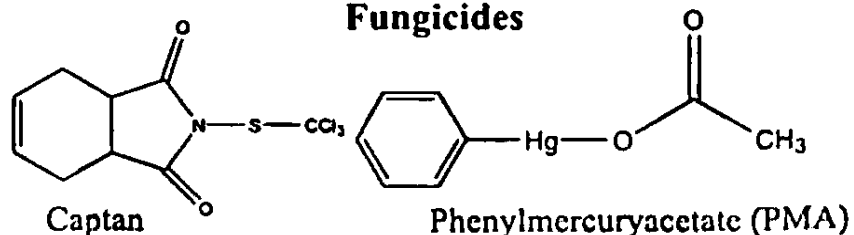
Chemistry is the central science which connects with physics and biology and geology. Chemistry deals with atoms and molecules. It explains the synthesis of compounds. Agrochemicals and fertilizers are mostly synthetic compounds and they are synthesized mostly from natural resources. In Sri Lanka we have a few natural resources that have opportunities to synthesis these compounds of agrochemicals and fertilizers. The Eppawalla rock phosphate is a raw material for the manufacture of phosphorous fertilizers such as Triple Super Phosphate (TSP) and Single Super Phosphate

(SSP). Limestone and corals are used as calcium nutrient as well as for soil reclamation. The defunct Paranthan Chemical factory produced hydrogen gas as a byproduct with other waste materials and this was used for the synthesis of ammonia which in turn is used for the manufacture of urea. The ammonia and urea are nitrogen fertilizers. Nitrogen, phosphorous and potassium (NPK) are the major nutrients of plants. The applications of agrochemicals are weedicides, fungicides, herbicides and insecticides etc. (figure 1) and use of these have increased the crop production significantly. The effect on the application of fertilizers on the crop yield is shown in table 1 and figure 2.

Insecticides



Fungicides



Herbicides

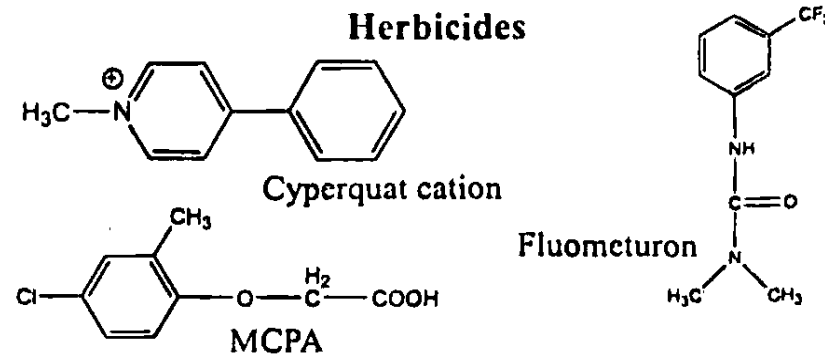


Figure 1: Commonly used agrochemicals such as insecticides, fungicides and herbicides.

Table 1: Fertilizer consumption and wheat yield. Source: FAO Production Year book, Vol. 37 (1983) and Fertilizer Year book, Vol. 33 (1983). FAO, Rome.

Country	Fertilizer Consumption (kg N+P ₂ O ₅ +K ₂ O per ha arable land and permanent crops)	Average grain yield (t/ha)
Germany	435	5.44
France	299	5.13
Italy	161	2.56
China	158	2.83
USA	87	2.65
USSR	87	1.61
Pakistan	62	1.68
Turkey	54	1.86
Canada	44	1.97
India	35	1.84
Australia	24	1.72

Table 2: Nutrient elements and chemical form in which they are taken up from soils.

Primary nutrients	Chemical form	Secondary nutrients	Chemical form	Micro-nutrients	Chemical form
Nitrogen	NH ₄ ⁺ , NO ₃ ⁻	Calcium	Ca ²⁺	Iron	Fe ²⁺ , Fe ³⁺
				Zinc	Zn ²⁺
Phosphorus	HPO ₄ ²⁻ , H ₂ PO ₄ ⁻	Magnesium	Mg ²⁺	Manganese	Mn ²⁺ , Mn ³⁺
				Copper	Cu ²⁺
Potassium	K ⁺	Sulphur	SO ₄ ²⁻	Boron	BO ₃ ²⁻
				Molybdenum	MoO ₄ ²⁻
				Chlorine	Cl ⁻

Commonly used fertilizers are based on NPK values in different proportions and it is based on the requirement by the particular crop.

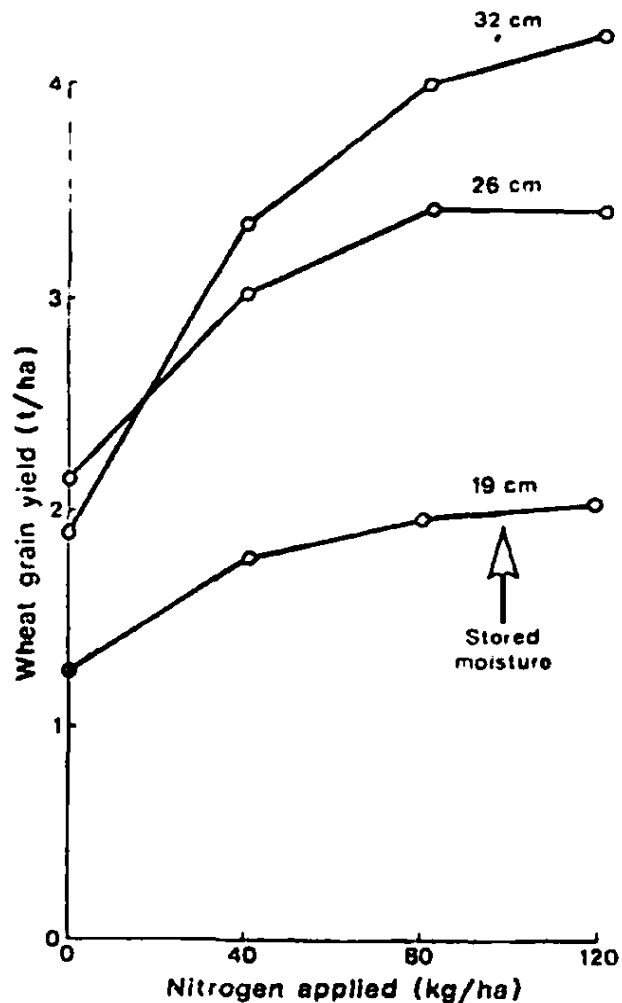


Figure 2: Response of rainfed wheat to nitrogen in soils with different stored moisture.

Soil pH and relative availability of nutrients are given in the figure 3.

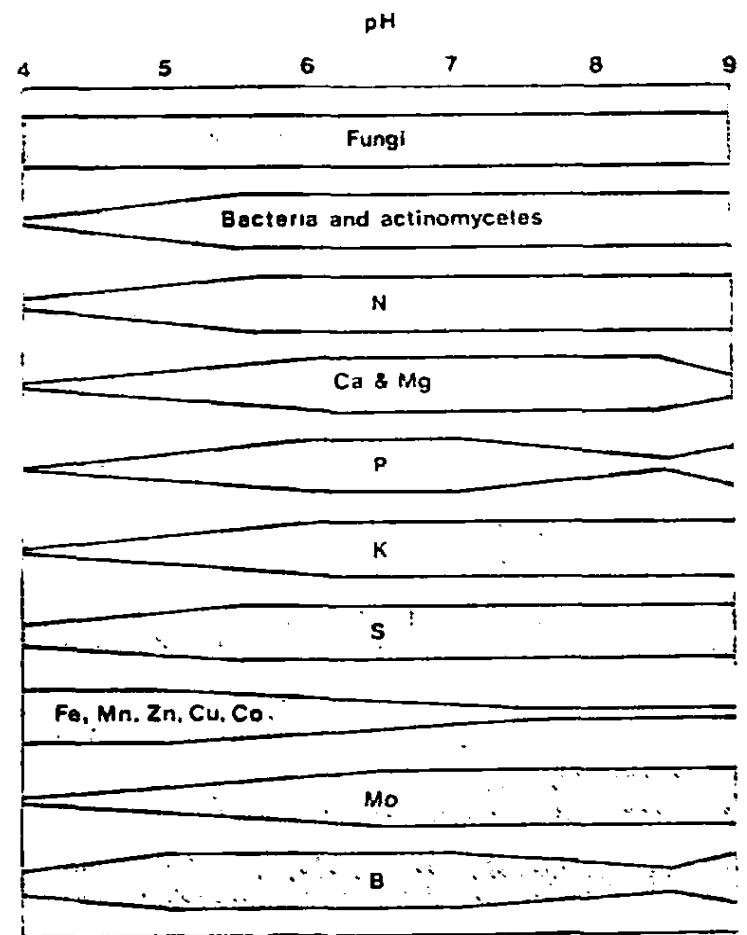


Figure 3: Scale of Soil pH values. Soil pH and relative availability of plant nutrients and activity of soil microflora (the wider the band, the greater the availability/activity).

Organic sources of plant nutrients such as farmyard manure, compost, green manuring contain NPK and considerable amount of sulphur and micronutrients. Inorganic micronutrients that are available on commercial scale as NPK fertilizers contain small amount of micronutrients such as copper, zinc, manganese, boron, molybdenum. These elements and their quantities depend on the source of the raw material and the process that has been used.

Agrochemicals and fertilizers are invaluable inputs to increase the agricultural production which needs to meet our large and ever increasing population. The government of Sri Lanka is providing a subsidy of Rs. 3000/= for every 50 kg bag of fertilizer sold in the market. The price of a 50 kg bag of urea is Rs 1200/= in the market whereas it cost to the government Rs. 4200/=. There is an urgent need to develop newer and safer chemicals and formulations for agrochemicals and fertilizers. Non-judicious use of these chemicals has created problems such as chemical contaminations in the environment by the presence of pesticide residues, on food and living beings. The current trend is to minimize the use of synthetic hazardous chemicals by replacing with non-chemical methods.

For the sustainable development of agriculture the technologies should be adopted to accentuate more efficient resource utilization of high productivity, better crop production and protection technologies. In the changing scenario more efforts are needed to modernize the existing technologies and develop new methodologies to produce more food for the people.

To achieve the leadership in agriculture sector the emerging areas that need consideration are;

- (i) Efficient soil and water resource management
- (ii) Integrated nutrient management
- (iii) Integrated pest management
- (iv) Increased use of biofertilizers
- (v) Use of biodegradable pest control chemicals
- (vi) Use of botanical and biopesticides
- (vii) Environmental engineering and pollution control
- (viii) Development of stress resistant crop varieties
- (ix) Raising new high yielding varieties and hybrid seeds through somatic cell fusion or protoplast fusion
- (x) Multiplication of genetically engineered transgenic plants.

Benevolent Fund Benefits for Members

- **Long life Benefits:** Rs. 10,000 (over 70)/Rs. 15,000 (over 75)/Rs. 20,000 (over 80)
- **Critical illness benefits** (upto Rs. 50,000)
- **International travel** for conferences (upto Rs. 50,000)
- **Balance 50% of Tuition fees** of any member's child following the Graduateship Programme (Since 50% concession is already by CCS, this will amount to a 100% waiver)

Any member who has paid membership fees for life (after 3 years of such payment) is entitled for these benefits. All members are advised to pay the membership fee for life and become beneficiaries.

Graduate Chemists Welfare Fund

This fund has been established with effect from 1-1-2012. The principal benefits towards CCS Graduate Chemists would be,

- a) To provide partial assistance towards international travel of those proceeding abroad for PG degrees (once a life time)
- b) To provide partial assistance towards registration fees in respect of IChemC/CCS events such as International Conferences (Preference for those presenting papers)
- c) To provide assistance towards registration fees for IChemC/CCS training seminars etc.
- d) To provide partial assistance towards activities of the Alumni Association.

Note: Depending on the demand, Graduate Chemists who maintain positive content and participate in IChemC/Alumni activities will get preference for the above mentioned benefits.