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Fertilizers

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Introduction: It is a well-known fact that in India, the population is steadily going up, while the productivity of the land is going down. It is this sorrowful state of affairs that leads our country to the verge of starvation at critical times as in world wars or famine. There is only one way of putting an end to this and that is by ensuring an increase in the yield per acre of our lands, through the use of fertilizers. Fertilizers alone can save us from famines.

Fertilizer production in India: The need for the use of fertilizers becomes clear in view of the insufficiency of available organics such as cattle manure and composts. The use of green manures is limited to soils which are fertile enough to support a green manure crop. In poor soils newly brought under cultivation as in the Lower Bhavani area, a good crop of green manure cannot be obtained unless nutrients are supplied to the soil. Supplying readily available nutrients to the hundred thousand acres is possible only in the form of artificials.

Our country is far behind all other civilised nations in the production and use of fertilisers. A glance at the figures relating to the consumption of chemical fertilisers in various countries of the world is enough to show that acre-yields of crops runs somewhat parallel to the consumption of fertilisers. In our country the production of fertiliser is not sufficient even to meet the present low demands. More factories for the production of nitrogenous and phosphatic fertilisers are needed. The use of fertilisers also has to be considerably stepped up. The following table shows a comparison of Indian production and consumption of fertilisers with that of Japan (F. A. O. Statistics, 1952). Factories as at Sindri have to be established in other parts of the country, and particularly in the South. The Trichinopoly deposits of phosphates have to be exploited for the production of fertilizers like silicophosphates and phosphoric acid.

Table showing the production and consumption of fertilizers in India and Japan

	Production		Consumption	
	India	Japan	India	Japan
	(In 1000 metric tons)			
Nitrogenous — as N	38	457	63	442
Phosphatic — as P_2O_5	13	285	13	243
Potassic — as K_2O	...	4·4	...	9·6

Profitable use of fertilisers : A review of manurial trials conducted in our State and the extensive soil surveys go to show that the requirements of our State with regard to manurial constituents are organic matter, nitrogen and phosphoric acid and for the best results, the artificials are to be used in conjunction with organics. Experiments on ryot's fields in Tanjore delta has also proved that the use of artificial nitrogen alone is not good enough and a combination of nitrogen and phosphoric acid is essential for maximum benefits.

One of the important factors in the efficient use of fertilisers is knowing how much to use and when, for a given type of soil. Of the many methods developed to determine this, the most practical one is the rapid tissue test. The procedure involved is very simple. Nitrogen is tested by adding a few drops of the nitrate reagent directly on the plant on the freshly cut tissue and the formation of a blue colour and its intensity are noted. Phosphate is tested by adding the phosphate reagents to freshly-cut tissue and the intensity of blue colour noted. These tests, though by themselves they are simple, require experience in interpreting the results. In a thorough study, tests can be made on plants from plots receiving known doses of nutrients and results of tests compared with yield figures as shown below :

Level of nutrients	0	1	2	3	4
Results of tests	0	low	medium	high	V. high
Yield	20	40	60	80	80

From the above results it is clear that to get maximum yield, nutrients at level 3 has to be applied and the test indicating High will be necessary. Level 4 can be avoided and to that extent the use of fertiliser can be minimized. Where a systematic experiment is not

possible, tests can be made on the current crops and approximate doses of nutrients can be added. The yield data obtained therefrom can be compared with the results of tests and the experience so gained can be used for the future. A certain amount of standardisation is also required for the different crops to derive maximum benefit from these tests, as the critical stage of crop growth at which tests can be made with advantage and the part of the plant that is best suited differ from crop to crop. Such standardisations are being attempted in the chemistry section of this Institute.

In planning for the future for the use of fertilisers, importance should be given for such field tests and testing outfits. The TCM soil testing in which mobile units are to be used is a welcome step in this direction. Encouragement should be given to the production of handy kits that can be carried on cycles, as is done in Japan.

Newer types of fertilisers and newer techniques for fertiliser use: Technological advances and commercial developments in the field of fertilisers have outstripped expectations and have now become major factors affecting the very destiny of mankind. This was one of the factors missing from the calculations of Malthusian disciples. Synthetic nitrogen materials of low solubility in water such as urea-formaldehyde type is likely to reduce the bill on nitrogen fertilisers. Liquid fertilizers with low vapour pressure such as liquid urea, ammonium nitrate are being produced. Spray applications of urea are already becoming popular. In the field of phosphates, newer types of material such as fused phosphates and silico-phosphates are being produced. Special types of mixed fertilizers (i) to meet specific needs of certain soils or crops (ii) for use with irrigation systems, sprayers or transplanting machines (iii) for use in culture solutions, fish ponds or home gardens and (iv) to combine fertilizer action with the control of weeds, insects, fungi and other pests have been developed.

Fertilizers for certain soils: In the absence of adequate soil-liming programmes, high yields of crops in the humid regions are not favoured. Under these conditions non acid-forming mixed fertilizers are used. Dolomite is generally included along with the acid-forming fertilizers such as ammonium sulphate and ammonium nitrate. For alkali soils, free sulphur is included in the acid-forming mixed fertilizers in addition to ammonium sulphate. For peat and muck soils which are often deficient in one or more of the trace elements, the trace elements are included in the mixtures.

Fertilizers for certain crops: Tobacco, legumes, potato, citrus etc., have specific needs for which special fertilizer mixtures have been developed. Thus tobacco fertilizers average much higher in MgO. and soluble nitrogen. For legumes mixed fertilizers containing P_2O_5 and K_2O, but no nitrogen and ground limestone to render them alkaline in reaction are designed. (Jacob 1952)

Liquid fertilizers: Advantage can be taken of liquid fertilizers such as aqua ammonia, phosphoric acid, aqueous ammonium nitrate etc., for use in irrigation systems. These are cheaper than the salts. In Western United States, liquid ammonia from steel cylinders is commonly applied to irrigation water on a service basis. (precipitaion of salts from the water can be prevented by applying a few parts per million of sodium hexametaphosphate to the water upstream). Liquid mixed fertilizers which have a low pH can be used on alkaline soils with advantage. (Jacob 1952)

The use of fertilizers for spray application and seed treatments hold promise. Treatment of seeds with 5% solution of dipotassium phosphate has given increased yields. Grass seeds spread in a mat of decomposable vegetable matter impregnated with fertilizers is marketted in rolls 20 feet long and 21/2 feet wide in U. S. A. This means of preparing lawn is said to prevent birds from eating the seed, to decrease soil erosion and to assure the purchaser of proper fertilization of the grass.

Herbicidal, fungicidal and pesticidal mixtures of fertilizers: Advantage can be taken of certain fertiliser materials that may serve not only as s source of nutrient but also to eradicate weeds or prevent the growth of fungi. Urea, calcium cyanamide etc., fall in this class. So also, some material used primarily to control weeds, insects or plant diseases also supply nutrients. Bordeaux mixture, borax, zinc chloride are among such fungicides. Certain recently developed pesticides for soil application are effective at rates of less than one lb per acre when they are placed in the seed or root zone of a crop. An example is the commonly known 2–4, D which kills the broad-leaved plants but are not toxic to most of the grasses and is being used in fertilizers without adverse effect on soil micro-organisms.

Chlorinated hydrocarbons used as insecticides such as DDT and chlordane have been used in mixed fertilizers. Similarly, fungicidal mixtures have been reported to be in use in America and

include various mercury compounds, sulphur, fermate, Dithane, Arasan etc., Apart from these, there are also the multiple purpose mixtures supplying nutrients, herbicides and pesticides such as 7—5—5 grade containing 1% of 2, 4–D and 0.25% Lindane.

Method of application: Fertilizers should never be placed directly above or below the seed though separated by a soil layer. The American National Joint committee on fertilizer application has published (1938 quoted by Collings) its recommendations for some field and horticultural crops and this could be followed with advantage in the placement of fertilizers for different crops.

Fertilizers have a bright future and this is especially true in our country as we are just entering the fertilizer age. Large-scale production of fertilizers have only just been started and much remains to be done in this important field in our country.