

Nobel Prize in Chemistry 1945



Artturi Ilmari Virtanen

The Nobel Prize in Chemistry 1945 was awarded to Artturi Virtanen *"for his research and inventions in agricultural and nutrition chemistry, especially for his fodder preservation method"*.

RESEARCH INFORMATION:

In our northern latitudes we have to feed our most useful domestic animals in winter with preserved fodder, generally hay. But for a long time it has been common knowledge that hay alone is insufficient to keep the animals in perfect condition. To be able even in winter to produce good quality milk in sufficient quantity our cows need concentrated fodder. Thus, so far they have been fed in most cases on oil cakes imported from warmer countries. Obviously, replacing these products imported from other countries by an indigenous feeding stuff would offer appreciable economic advantages for our agriculture.

This is precisely the achievement of the AIV method elaborated by Virtanen and denoted by the initials of his name. Therefore the Swedish Academy of Sciences has decided that his research and discoveries in the field of agricultural and nutrition

chemistry, and particularly his method of preserving animal fodder, have qualified him for the Nobel Prize for Chemistry, 1945.

For a long time Virtanen had been seeking to make what contribution he could to improving the supply of feeding stuffs in his country. With the indomitable tenacity which marks the sons of Finland he never lost sight of that objective and stubbornly persisted in carrying out his research programme.

Leguminous plants such as clover, vetch and lucern are green fodder which, when harvested in due season, provide cattle with the vitamins and proteins necessary for them to achieve full production capacity. In seeking to achieve by rational and economic cultivation a green fodder with the maximum protein content Virtanen was led to study the conditions of nitrogen assimilation and of protein formation in vegetable organisms. Displaying great ingenuity, he attempted to solve the difficult problem of the process whereby the leguminous plants fix atmospheric nitrogen by means of bacteria contained in their tubers. The original aim of these studies has still not been achieved but their results are already valuable and hold promise of being very important.

In his attempts to improve the availability of feeding stuffs in Finland, Virtanen also founded on purely theoretical data his method of preserving green fodder, a method which avoids protein loss and minimizes vitamin loss.

It had long been known that the addition of organic or mineral acids to ensilage inhibited the breathing of the vegetable cells as well as all the fermentation processes. There have been frequent endeavours to turn this phenomenon to practical account. However, these attempts were carried out empirically and without serious study of the conditions for conserving the nutrient value of the fodder, or for using it as an animal feeding stuff. By his systematic, thorough studies Virtanen was the first to solve this problem.

To preserve fodder Virtanen uses hydrochloric acid with the addition of sulphuric acid. After painstaking, protracted studies he determined the limiting degrees within which the acidity must be kept in order to achieve the required result. The following beneficial

results are simultaneously obtained. The breathing of the plant cells, which consume readily soluble carbohydrates is reduced to a minimum, particularly if the fodder is well stacked. The lactic-acid fermentation ceases or remains at an insignificant level. The butyric-acid fermentation, which decreases the attractiveness of the fodder and lowers the quality of the milk, ceases. Protein decomposition, which is apt to cause heavy financial losses, ceases almost altogether. The content of vitamin A and carotin is maintained and vitamin B and vitamin C are also well preserved. Vitamin-rich milk and butter are very important for public health and AIV fodder provides an effective means of improving this supply of vitamins. Because of these fodders "summer milk can be produced the whole year round". AIV fodder has no deleterious effect on the animals which readily consume it. Some weeks after the silo has been charged the mineral acids are neutralized and fixed in the form of salts by the basic products contained in the fodder, while harmless organic acids are liberated. AIV fodder has frequently assisted in improving the condition of animals, their fertility and resistance to disease.

One merit of the AIV method is that it also enables second crops of grass gathered in the autumn to be ensilaged, regardless of the atmospheric conditions, and thus permits economic use of this fodder which, more often than not, cannot be used as hay.

Virtanen is not an office-bound scientist. Himself a farmer, he has tried out the most appropriate ways of applying his ensilage system.

This system has become established in Finland. A flight nowadays over the farming areas of southern Finland shows one or more pits near almost every farm. The observer may perhaps think that they are the traces left by the bombardments of the last war. Nothing of the sort. They are silos filled with AIV fodder. In Sweden too the AIV method is becoming increasingly appreciated. Between 1932, the year when it was applied for the first time, and today, the quantities of green fodder prepared by the AIV method have doubled or tripled every four years. Last year they rose to 295,000 tons. The use of the method has increased appreciably during recent years in Denmark and Great Britain. It is also applied in Norway and Holland. In America as well it has stimulated growing interest

and is each year being increasingly practised. In America and Germany large quantities of silage are prepared by methods which may be considered as variants of the AIV method. Virtanen's studies provide a firm basis for future research in the matter of silage.

Professor Virtanen. I do not think I am wrong to say that it is in your ardent patriotism that we must look for the most powerful force inspiring your great scientific achievement. During your years of effort Finland remained for you as for the noble commandant in Runeberg's poem: "the sullen, needy, humble, and holy Fatherland". By your work you have confirmed that the person who places his sincerity and a tireless zeal at the service of his kin and of his country, without thought of himself and without seeking for personal profit, also serves the interests of humanity. Perhaps your eyes are fixed more attentively than ever on the difficult biochemical problems which you have set yourself to solve and to which you have made so many important contributions. For that reason we are certain that your studies will again bear fresh fruit. It is a joy for our Academy to be able to give you new means of attaining the aims which you have set yourself. We warmly wish you prosperity and I would ask you to receive from the hands of His Majesty the King, the Nobel Prize for Chemistry for the year 1945.

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