need not be a disadvantage if the space is required for other purposes, such as machinery storage during the summer. Excluding such alternative uses, there is no doubt that storage to a depth of twelve feet is cheaper per ton than is shallow storage. The store should not be less than twenty-four feet wide if machinery is to be manœuvred without difficulty, nor more than thirty feet wide because of difficulties in air distribution if deep storage with bottom ventilation is practised. For storage until March sufficient insulation is provided if the walls have a transmittance value of 0·2 B.Th.U./sq. ft. hr. deg. F. difference, and, if with such walls the roof is insulated to give a transmittance value of 0·15, condensation and drip are prevented. The most efficient means of ventilation is by a thermostatically controlled power-driven fan delivering to ducts under the potatoes. Manual control usually results in less cooling and more ventilation, which latter is to be avoided because of the wilting caused. Bulk harvesting has proved more efficient than other methods, and an elevator-loader has been designed to handle potatoes in bulk. It has a hopper to receive bulk loads from standard tipping trailers and has an outreach of twelve feet when loading to a height of twelve feet. A loading-rate of twelve tons per hour has been reached over short periods, and the turn-round of vehicles with two-ton loads has been achieved in less than seven minutes. Preliminary studies on the comparative costs of clamping and indoor storage indicate that a capital expenditure of £5 per ton on storage accommodation is justifiable, even leaving out of consideration such important advantages of indoor storage as independence of weather conditions during grading. In reply to a question Dr. Wilson stated that the ventilating unit of a grain dryer can probably be used to ventilate a potato store, and, in fact, some farmers are experimenting with such dual-purpose installations using the platform-type sack dryer.

If food is produced far in excess of the need for it, its storage or wastage is a matter of indifference. At the other extreme we may have conditions such that the conservation of farm products to the greatest possible extent is an overriding necessity. For each product mentioned during the discussion, methods of storage are known which will preserve a very high proportion of the value for much longer than is normally necessary; but such methods are regarded as uneconomic under present conditions. It was clear from the discussion that the methods adopted and being sought in practice are therefore compromise attempts to preserve as much as possible within the framework of the present relative values of farm products and the apparatus necessary to preserve them.

## LIMITS TO INTENSIVE PRODUCTION IN ANIMALS

ON August 14 at the Edinburgh meeting of the British Association, Section M (Agriculture) held a symposium on "Limits to Intensive Production in Animals". Prof. R. A. Fisher, Balfour professor of genetics, University of Cambridge, read the first paper, taking for his subject "Genetical Limits to Intensive Production in Animals". He referred to farm animals as part of a farmer's machinery for turning material from a less valuable into more valuable form, and said that in the designing of such material the geneticist can make an important contribution. He commented on the separation of genetics and biometry as university subjects dealt with in different departments and taught to different sets of students, thus creating a difference of outlook and preventing progress: he felt that because of this unnatural separation it would be difficult in the future to find personnel with the necessary outlook, although they may be well trained in one or other of the subjects. Prof. Fisher's view is that the work on the breeding of farm animals is so technical and the precision of the biometrical determinations involved are so important that it is necessary to set up biometrical laboratories for the purpose. The genetics of farm livestock have been neglected in the development of the general subject of genetics. This Prof. Fisher attributed to several causes: the two World Wars have shaken the national economy of Great Britain, and there is also to be considered the economic revolution, which has interfered to some extent with the prospects of the older methods employed for livestock improvement. Livestock breeding is slow and expensive, and therefore has not been given its rightful place in research work; in fact, the whole subject of genetics has been left to amateurs and teachers and, therefore, it is but natural that such workers should prefer mice or birds for their work, rather than farm animals. He remarked on the work during the past forty years on *Drosophila* and claimed that these studies have done more towards an understanding of genetic improvement in livestock than have all the efforts made up to date with livestock themselves. He agreed that some beginnings have now been made on serious research work; but he wondered if public officials really think or imagine that a centre for the study of pure genetics of each of the larger species of animals could be of any importance for livestock improvement. Prof. Fisher's final remarks were: "As a last optimistic consideration, let me point out that land long fallowed is sometimes very productive; that unworked gold mines are the best gold mines. Because nothing effectual has been done, we may at least feel sure that the law of diminishing returns has not yet set in, as seems to be the case in some fields of plant improvement, and the ceiling of genetic potentiality is still a long way off."

In the discussion on Prof. Fisher's paper, Dr. H. P. Donald, of the Animal Breeding and Genetics Research Organization of the Agricultural Research Council, directed attention to the recent establishment of the Organization, the object of which is to study the genetics of livestock. The work is long-term, and results will not be available for some time to come. Dr. Donald pointed out that little publicity has been given to the setting up of this Organization, and it may be that this is the best procedure because it will be a long time before any results will be produced for application to the industry.

Further discussion centred around the efforts of practical farmers for livestock improvement, and it was claimed that, by the use of sires selected for specific qualities, improvements have been obtained in some breeds of cattle.

Dr. John Hammond, University of Cambridge, who spoke on "Physiological Limits to Intensive Production in Animals", referred to the British Friesian cow which recently attained a new world record in milk production, yielding in its lifetime nearly 120 tons of milk. He also referred to other high milk-yielding cows as illustrating that the limits of production have not yet been reached; in fact, he considered that there are no physiological limits to

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intensive production, provided that suitable nutrition and other environmental conditions are applied. Dr. Hammond showed by diagrams how a system of priorities operates whereby nutrition is supplied from the blood stream for the various body tissues and how the animal adjusts itself to the nutritional requirements. A balance is obtained according to the needs of the different tissues and the extent to which they are developed in the make-up of the animal; in cows in which high milk yields are being developed, the requirements for udder development are greater than those in the poorer milk yielders. He also dealt with pigs, in which he showed that, after feeding at a high nutritional level, better growth and development results if the high level is maintained.

Sir Thomas Dalling, chief veterinary officer, Ministry of Agriculture and Fisheries, took as his subject "Relationship of Animal Health to Production". He pointed out that in the absence of a healthy animal the results of attempted improvement in production may fail. He pleaded for a better understanding of the physiology of some of the important systems in the animal body, the study of which has been long neglected but is now being taken up largely through the efforts of the Agricultural Research Council. Infectious diseases must always limit increased production, and therefore a better understanding of their nature and how they spread is necessary; much attention has been given to their control throughout the world, and measures are being successfully practised. Sir Thomas referred at some length to bovine tuberculosis and the limits its presence in cattle places upon production. Research work has resulted in the application of schemes for its control, and eradication from Great Britain is now being undertaken. Venereally transmitted diseases and the value of artificial insemination in their control were also referred to. Dealing with increased yields of milk, special attention must be given to the health of the udder and the prevention of mastitis. In addition to the knowledge that certain micro-organisms play a part in the causation of mastitis, Sir Thomas referred to the necessity for adopting satisfactory husbandry and hygiene procedures to prevent injury to the udder tissues. He mentioned the necessity for regard for the health of an animal from the time it is conceived and throughout its young life; he stressed the importance of feeding colostrum to the newly-born animal. His remarks also covered the health of pigs and the need for close attention to nutrition whereby a sudden change in the bacterial flora of the digestive tract may be prevented. He gave as an example the finding of large numbers of micro-organisms of the salmonella group in the intestine, following the use of unsuitable diets. Sheep and poultry were also dealt with—the susceptibility of the former to infections with anaerobic micro-organisms, especially when in a thriving condition, and the high incidence of disease in the latter associated with high egg production.

Dr. A. S. Parkes, National Institute for Medical Research, discussed the "Preservation of Spermatozoa at Low Temperature". He showed a film which illustrated the freezing and thawing of red blood cells and spermatozoa in the presence of 15 per cent glycerol, the thawed cells being unimpaired. In the absence of glycerol the spermatozoa do not resume motility. Fowl spermatozoa so treated have been shown to retain their fertilizing capacity. Dr. Parkes thought that, with further refinements of technique, it would be only a matter of time before semen from bulls and other animals could be kept in a frozen condition and used long after it was obtained from the animal: in fact, he foresaw that an animal would be used as a sire long after its death. The results of this work have an important practical application. In artificial insemination as a method of breeding there is a heavy loss of semen, for it is not always possible to adjust supply to demand. When Dr. Parkes and his colleagues have progressed further in their studies, it is to be hoped that they will be able to show that semen from livestock can be preserved with results similar to those they have obtained in poultry; this will be an important forward step in improving livestock production by the greater use of selected sires.

## ADVISORY COUNCIL FOR SCIENTIFIC POLICY

THE fourth annual report of the Advisory Council on Scientific Policy* covers the period April 1950–March 1951 and, apart from the discussion of the implications of the Colombo Plan for the employment of scientific workers, technologists and other experts from Great Britain and of the recommendations of the Committee on Toxic Substances in Consumer Goods, which occupy the greater part of the report, covers much the same ground as the third report. In regard to scientific man-power the report notes that the rearmament programme will make particularly heavy demands for physicists, chemists and engineers. The Advisory Council admits that the views expressed in its last report regarding the supply of scientific men under-estimate the difficulty and that over a wide field the demand exceeds the available supply. It has set up a standing Committee on Scientific Man-power, on which the Ministry of Labour and National Service and the University Grants Committee are represented, to deal with the position. The membership of this and of other standing committees set up by the Advisory Council is detailed in an appendix. A particular question of scientific man-power, that relating to biologists, has been remitted to another of these committees, that on Biology and Allied Sciences, and this committee reported that while more general botanists and zoologists than can find employment as such may be graduating, there is a continuing shortage of most kinds of biological specialists, particularly of those suitable for employment by the Agricultural and Medical Research Councils and for posts overseas. It is unlikely that this shortage will be made good for several years, and it may be accentuated if the plans for economic development of under-developed areas, whether under the Colombo Plan or in other parts of the world, come to fruition and the biological work of the Colonial Service increases.

The Advisory Council recognizes the great scope for expansion of Colonial research, and that such expansion is likely to be limited by a shortage of scientific workers trained in the necessary disciplines as well as by financial stringency. It is equally concerned that the demands which the numerous agencies concerned with the development of backward areas may make upon British resources of scientific man-power cannot be met, if all the plans discussed come to fruition, without serious damage to other

* Fourth Annual Report of the Advisory Council on Scientific Policy (1950–1951). Pp. 18. (London: H.M. Stationery Office, 1951.) 9*d*. net.

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