SEAWEED AS A FOOD FOR LIVESTOCK

By J. BEHARRELL

FACTS and figures concerning the extent to which seaweed in the form of a dried meal is incorporated in balanced rations for cattle, sheep, pigs and poultry are surprising and confirm the value placed upon seaweeds by the people of the Far East. Those who have lived in China know the value placed upon seaweeds. The Chinese import the dried product from the Pacific coast and use it daily as an important part of their diet; it forms one of the chief sources of supply of mineral salts. In the Hawaiian Islands more than seventy species of seaweed are reputed to have food value, but so far as is known no one has yet attempted to classify the world's Algæ, or even those of any country, according to their edible qualities. These appear to vary widely as to plants and in the parts of individual plants.

Among the most recent analysis of dried seaweed meals are those made in June 1939 by Dr. Bernard Dyer and Partners of London, which show the following:

	Norwegian	Scottish
Moisture	13·58	15·50
Oil or fat	4·40	1·50
Albuminoids	6·90	10·90
Digestible carbohydrates	53·95	35·30
Fibre	5·07	9·30
Ash	16·10	27·50
Mineral Matter		
Phosphoric acid	0·46	0·83
Lime	2·15	3·51
Magnesia	0·17	0·38
Sodium chloride	2·70	6·73
Soda in other forms	1·64	
Potassium iodide	0·07*	0·65†
„ chloride		4·98
Potassium in other forms	1·98	3·98
Iron oxide	0·10	0·32
Silica	0·20	1·40
Carbon dioxide, sulphur trioxide, etc.	6·63	4·72
Carotene	6·2	0·3

(parts per million)

* Equivalent to 500 parts iodine per million.
† Equivalent to 5,000 parts iodine per million.

While the analysis quoted gives the amounts of the major elements present—a spectrographic examination of the same product by the Macauley Institute for Soil Research carried out in March 1940 reveals the presence of sodium, calcium, magnesium and potash, with small quantities of barium, strontium and lithium and a trace of rubidium. Other elements observed in the ash were titanium, aluminium, iron, manganese, silicon and a trace of copper. The non-metals are not easily determined by spectrographic analysis, but the report states that copious iodine fumes were observed on ashing.

The concentrate, with the alkalis and alkaline earths removed, showed the presence of the following—quoted as parts per million of the original seaweed meal:

Cobalt	0·2	Vanadium	1
Nickel	10	Molybdenum	1
Tin	1	Gallium	0·5
Lead	1	Chromium	1
Silver	0·5	Lanthanum	10
Zirconium	3	Gold	
Zinc	40	Thorium	
Copper	10	Scandium	

The other trace elements mentioned are present in amounts of 1–10 p.p.m. but it was not possible to determine the exact percentages as no suitable standards were available.

This spectrographic analysis indicates the potential value of this product of the sea as a food for livestock.

Evidence of the value of seaweed for farm stock recently came from New Zealand (*Weekly News*, July 16, 1941).

The Laplanders feed seaweed to their cattle and so do the inhabitants of the Faroe Islands. In the Orkneys the magnificent stock is fed on seaweed as a proportion of their ration. At Stronsay in the Orkney Islands Laminaria is used. This is first dried by sun and air, being spread out thinly and treated as quickly as possible after being taken from the sea, otherwise it tends to decompose and is then unfit for stock feeding. Collection is made at all times of the year, but it is found by analysis that the iodine and mineral value is highest in the late summer and autumn. According to certain authorities it is an advantage to wash the weed and so remove any surplus salt.

The method employed in the north of Scotland is to dry the weed, and more particularly the long slender stipes (which are richer in iodine) by sun and air for several days, then to slice the latter by means of a special cutter, followed by a grinding process to reduce it to a fine grist.

This is finished on a rotary dryer—at a temperature varying from 350° C. to 450° C. for a period of forty minutes—and is later ground in the usual Christy and Norris type of disintegrator, when it is ready in fine meal form for blending in various types of feeding stuffs or in concentrates. The percentage used in the compound food is small, the usual rate being 1 per cent of the total food (by weight), but this can be increased to 2 per cent or slightly more with perfectly good results. Stock fed with this addition to their ration have increased stamina and a stronger resistance to disease. In the United States the Overbrook Dairy Herd, receiving dried seaweed meal in their ration, won the World's (Herd) Record for milk production.

A comparison between oats and a meal produced from dried *Laminaria flexicaulis* gathered on the coast of Brittany was actually made in a communication to the French Academy of Sciences in 1918. It gave the following figures:

	Oats	Dried Laminaria meal
Water	12·55	14·40
Carbohydrate matter	66·80	52·90
Nitrogenous „	9·10	17·30
Cellulose	8·45	11·50
Mineral matter	3·10	3·90

Results of feeding experiments gave 3 lb. of the meal as being equal in feeding value to 4 lb. of oats.

As 8–9 tons of fresh seaweed are required to dry down to 1 ton of fine meal, one million tons of seaweed would therefore produce the equivalent of 150,000 tons of oats, together with 1,200 tons of fertilizing material rich in potash.

It has been stated that in the islands of the Orkneys alone 30,000 tons of seaweed are available each year, so that the total quantity available round our coastline must be millions of tons.

With the backing of scientific research and practical feeding tests a vast reserve might be created to the great gain of our farmers and our stock feeders.

Present-day methods of gathering and processing by mechanical power might be improved—manufacturing costs, per ton, reduced to an economic level. There is evidence now that seaweed would provide food for farm animals in the years after the War, and profitable by-products for industry.

A considerable business has been created on the Californian coast to exploit the enormous jungles of giant kelp (*Macrocystis pyrifera*) which grows in the Pacific up to lengths of 500 ft. A machine mounted on a barge shears off the tops to a depth of three feet, which is the maximum permitted by the Government. Taken ashore, the kelp is treated in a similar way to that used in Scotland—dried in steam-heated or hot-air cookers, and ground to a fine powder, which must pass through a twenty-mesh sieve. The product is known as kelp meal and is mixed with a proportion of fish meal and sold as a seameal concentrate. Apparently not more than one tenth of the kelp meal harvested on the Pacific coast is prepared for stock food; all the rest is used for the extraction of iodine and for sodium salts.

The urgent need is for carefully checked records of the sea vegetation available, of the chemical value as a feeding stuff, for detailed digestibility trials, for the quantities required by stock to secure maximum results, and of its effect upon the health of all farm stock—a wide programme but one that should ultimately bring to agriculture thousands of tons of valuable home-grown feeding stuffs, from the sea-bed.

FORESTRY IN MALAYA

ONE reads with intensified interest the report of the progress of forestry in Malaya, now, we may trust for but a brief period, put to an end by the irruption of the Japanese. J. G. Watson, the head of the Forestry Department (if we omit the local inter-divisions of forestry administration of but little interest to the outside world), has written the "Annual Report on Forest Administration in Malaya including Brunei for the year 1940" (F.M.S. Govt. Press, Kuala Lumpur; 1941). In the report for the preceding year his predecessor, very fortunately as may now be thought, gave a valuable and interesting history of the growth of the Department from the year 1883 (see also NATURE, 148, 312; 1941).

In a general review of the year Mr. Watson mentions some small additional reservations of forest (347 square miles), bringing the total area of Government forest reserves to 10,879 square miles or 20·4 per cent of the total area. The actual area covered with forest of one type or another in Malaya is almost 77 per cent, 56·6 per cent of forest land being still unaccounted for. It is the existence of this mass of tropical forest covering the region which enabled the Japanese to penetrate so easily through the country.

Some interesting sylvicultural work was being undertaken, an all-Malayan regeneration *coupe* having been laid down for the conversion of inland forest. This annual *coupe* has been tentatively fixed at 12,088 acres; 1,000,000 acres have been set aside for this intensive management, of which 34,458 acres had been fully regenerated. The director of forestry says of this scheme that it is not yet fully operative in the more backward States where State land resources are still large. Differentiation between hard-wood and soft-wood areas is not possible as yet, but preference is given to those rich in the former. Eventual control will have to be on the basis of volume rather than area so far as hard-woods are concerned. It is sad to think that a certain proportion of this work will probably be lost, smothered by a victorious jungle of weed growth now that the attention of the forester will temporarily be no longer available. For those with a knowledge of the processes of growth in the tropical jungle are well aware that regeneration work of this kind can only be successful if carefully watched and given full assistance during the early critical periods. Already this work was becoming more difficult owing to the reduction of the staff through members joining the fighting forces.

This latter strain was, however, perhaps even more heavily felt in connexion with the timber industry and the numerous saw-mills of which there were eighty at work in connexion with the forests; fifteen of these mills are in the Straits Settlements (Singapore and Penang), forty-five in the Federated Malay States (Perak, Selangor, Negri Sembalin, Pahang) and twenty in the Unfederated States (Johore, Kedah, Perlis, Kelantan, Trengganu, Brunei). The combined outturn of all mills outside the Straits Settlements was 123,183 tons of 50 cub. ft. as compared with an estimate of 98,580 tons from Penang and Singapore. Apparently these two latter also saw up logs coming from Sumatra.

War conditions threw a heavy strain on the timber industry, which was (and, says the report, "will continue to be") hard put to meet emergency orders without dislocation of normal undertakings. The total outturn of logs was nearly 3,000,000 higher than the preceding year, the sawn timber running roughly each year at the same figure of 4,900,000 cub. ft. The one ply-wood factory produced 20,000,000 sq. ft. of three-ply sheets, and the four match factories seventy-three million boxes of forty matches apiece. The revenue from the forests during 1940 was 2¼ million dollars.

In spite of the absence of a number of officers detached to war duty, a certain amount of research work was continued throughout the year under various heads. It may be hoped, however, that when the department once again starts work in its forests more attention may be paid to preparing some working plans, the absence of which, in so advanced a department in many respects, is a curious anomaly.

If the annual report of 1940 is likely to be the last to be printed until the Japanese are sent out of Malaya, what can be said for the present prospects of the *Malayan Forester*, the December 1941 number of which has just been received?

An article on "The Contribution of Tropical Forests to War Economy", by H. E. Desch, wood technologist in the Forest Research Station in Malaya, is not without interest. In fact, it stresses without being aware of the fact, some of the dangers of the war exploitation of tropical forests already mentioned in NATURE. "A country rich in forests", says the author, "is obviously under an obligation to ensure that full use is made of its forests in War." This is undeniable, but it is just that "full use" in the case of the tropical forest which requires to be definitely understood. Too often the forest, at the mercy of the fellings of the timber merchant without expert supervision, has been ruined. The surprising demands which modern war make upon the forest are exemplified in a paper, "Forest Products and Defence", by C. P. Winslow, director of the U.S. Forest Products