

extrude their eggs at other times, it may be in the fall, winter or spring. During a period of seven consecutive months five traps were kept set in the harbor of Wood's Holl, Mass., December 1, 1893, to June 30, 1894, and visited daily. In all 168 egg lobsters were taken; 44, or 25.6 per cent. of the number, bore eggs which had been laid in the fall and winter.

I have tabulated 51 lobsters coming from different parts of the coast of Maine, having external eggs which had been laid out of the usual season of July and August. In one case at Matineus Id., Maine, February 4, the eggs had been extruded but a few hours, and the yolk was unsegmented. Another from York Id., Maine, November 15, had eggs in a late state of segmentation of the yolk. Still another from Brimstone Id., Maine, January 27, had eggs in the nauplius stage. At Wood's Holl, 1889 to 1893, the recorded observations (over 300 in all) show that the greatest number of eggs are laid in the last two weeks of July, the whole period lasting from June 16 to August 31. Data from the Maine coast (120 observations) indicate that the greatest number spawn in the first two weeks of August.

The spawning period of lobsters in the extreme north is said to last from July 20 to August 20, in Newfoundland. July and August are the months commonly assigned for the spawning in Prince Edward Island.

Number of Eggs Laid and Law of Production.—In the course of the work of lobster hatching at the station of the United States Fish Commission at Wood's Holl, it becomes necessary to remove the eggs from a large number of lobsters. These are carefully measured and the number deduced by simple calculation. I have tabulated the number of eggs laid in 4,645 lobsters measuring from 8 to 19 inches. In examining the column of averages one is struck by the fact that a ten inch lobster bears twice as many eggs as one eight inches long; that a twelve inch lobster bears twice as many as one ten inches long. It is therefore suggested that in early years of sexual vigor there is a general law of fecundity which may be thus formulated: the number of eggs produced by female lobsters at each reproductive period varies in a geometrical series; while the lengths of lobsters producing these eggs vary in an arithmetical series. If such a law prevails, we would have the following:

Series of lengths in inches.

(1)	(2)	(3)	(4)	(5)	(6)
8	10	12	14	16	18

Series of eggs:

5,000 : 10,000 : 20,000 : 40,000 : 80,000 : 160,000

An examination of the table shows how closely the first four terms of this series are represented in nature, and that when the 14-16 inch limit is reached there is a decline in sexual activity. Yet the largest number of eggs recorded for lobsters of this size show that there is a tendency to maintain this high standard of production even at an advanced stage of sexual life.

A graphic representation of the fecundity of the lobster tells more forcibly than words or figures can do how closely it conforms to the law just enunciated. The curve which we obtain is the wing of a parabola; the curve of fecundity is parabolic up to the fourth term, where the ratio of production is distinctly lessened. The largest lobster, carrying the largest number of eggs, was obtained at No Man's Land, June 9, 1894. It was sixteen inches long and carried one pound of eggs, estimated to contain 97,440. It is safe to assume that the average number of eggs laid by a lobster eight inches long is not above 5,000. The large lobster just mentioned, on account of the incumbrance of its eggs, was unable to fold its "tail," which suggests the explanation of the rudimentary condition of the first pair of swimmerets. If these appendages were of the average size, the large number of eggs which would naturally adhere to them would make folding of the abdomen impossible, and it is by folding the "tail" that the egg-bearing lobster so successfully protects her eggs and eludes her enemies.

Period of Incubation.—Summer eggs which are laid in July and August are ordinarily hatched in June, after a period of from ten to eleven months. Nothing is known about the hatching of fall and winter eggs. The majority of the eggs which are hatched at Wood's Holl complete their development in June.

That young are hatched at other times is certain, and we should expect this to be the case from the variations which occur in the time of ovulation. Capt. Chester in 1885 hatched some eggs at Wood's Holl Station on the 8th of November and the following days, the temperature of the water varying from 54.3 to 56 deg. Fah. Some lobsters were hatched early in February in 1889 at the hatchery of the Fish Commission Station at Gloucester, Mass. The water was very cold, and it was estimated that as many as 10,000 lobsters were hatched.

Period of Sexual Maturity.—Lobsters become mature when measuring from 7½ to 12 inches in length. Very few under 9 inches long have ever laid eggs, while but few have reached the length of 10½ inches without having done so. The majority of female lobsters 10½ inches long are mature. Anatomical evidence shows that the period at which lobsters become mature is a variable one, extending over several years.

Frequency of Spawning.—The adult lobster is not an annual spawner, but produces eggs once in two years. This is proved by the anatomical study of the reproductive organs, and confirmed by the percentage of egg-bearing lobsters which are annually captured. In a total catch of 2,657 lobsters, December 1 to June 30, 1893 and 1894, the sexes were very nearly equally divided, and about one-fifth of the mature females caught bore external eggs. The catch off No Man's Land in 1894 amounted to 1,518 lobsters; 93.5 per cent. were females, and 63.7 per cent. carried eggs. When these results are averaged it is found that about one-half of the females carried eggs, as would be the case if they spawned every other year. Ehrenbaum is without doubt mistaken in supposing that the lobster does not breed oftener than once in four years (Der Helgolander Humer, ein Gegenstand deutscher Fischerei. Aus der Biologischen Anstalt auf Helgoland, 1894).

Gastroliths.—Gastroliths are known only in two Macroura, the lobster and crayfish, and were observed in the lobster for the first time, and recorded by Geofroy the Younger, in 1709. Though a differentiated part of the cuticle, they are not cast off in the moult,

but are retained and dissolved in the stomach. Their structure in the lobster, consisting of hundreds of small spicules, makes the solution of them possible in a very short time.

The gastroliths have been supposed to possess great medical properties and to perform a variety of functions, the most common and accepted belief being that they play an important part in the provision of lime for the hardening of the new shell. The small quantity of lime which they contain, however, not more than one one hundred-and-twenty-sixth of that of the entire shell, according to an analysis recently made by Dr. Robt. Irvine, shows that this is relatively unimportant. Fragments of lime, furthermore, are always at hand, and are frequently eaten by the soft lobster, shortly after ecdysis, in the adolescent stages at least. It is more likely that the gastroliths are the result of excretion of lime which is absorbed from parts of the shell to render moulting possible, and that their subsequent absorbtion in the stomach is a matter of minor importance.

Rate of Growth.—Larvæ increase in length at each moult (stages 2 to 10) from 11 to 15.84 per cent., or on the average about 13.5 per cent. (measurements from 66 individuals).

The increase in the young at each moult agrees quite closely with that seen in the adult, where the increase per cent. in ten cases was 15.3 per cent. Allowing an increase per cent. at each moult of 15.3—probably not excessive for young reared in the ocean—and assuming the length of the first larvæ to be 7.84 mm., we can compute approximately the length of the individual at each moult.

Length at 10th moult 28.23 mm.			
" " 15th " 57.53 "	"	"	"
" " 20th " 117.24 "	"	"	"
" " 25th " 258.90 "	"	"	(9.5 inches).
" " 30th " 486.81 "	"	"	(19.1 inches).

According to this estimate a lobster two inches long has moulted 14 times; a lobster 5 inches in length, from 20 to 21 times; an adult from 10 to 11 inches long, 25 to 26 times; and a 19 inch lobster, 30 times. These estimates do not, I believe, go very far astray. We see them practically verified up to the tenth moult.

The time interval between successive moults is the next point to consider. Here the data are very imperfect. How long is the three-inch lobster in growing to be six inches long? Probably not more than two years and possibly less. This is supported by the observations of G. Brook. We therefore conclude that a ten-inch lobster is between four and five years old, with the highest degree of probability in favor of the smaller number. FRANCIS H. HERRICK.

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FOSSIL LAND SURFACES OF THE SILURIAN.

By W. R. MACDERMOTT, M.B.T.C.D.

IN the common way, a fossil is a shell, a bone, a tooth, print of leaf, of footprint, of raindrop even. Up in a railway cutting near the mouth of a tunnel, whose far-off exit looks like a dollar out of one's reach, as dollars so often are in spite of the judicious efforts of Congress to make them as plentiful as blackberries in autumn, let us look for a fossil on a larger scale.

We begin, however, with what may be called a shell. Breaking away a bit of this thirty-foot high wall of coal black slate, we get what we want, a little golden saw. Opinions, of course, differ as to the nature of this object. Our Irish peasant would say that it is the hidden treasure of leprachaun or fairy shoemaker (see "Standard Dictionary"), and had better be let alone, afraid it might be missed. Not concurring in this idea, the paleontologist calls it the fossilized chitinous case of a graptolith, an extinct zoophyte allied to the sertularia and virgularia of modern seas. In favor of the first opinion, it must be said that when we bring the thing home with us away flies its lovely gold. Nothing have we left but unmistakable brass and lead, proving past doubt that the fairies do not put up with such unscrupulous robbery.

Monograpthus gregarius the unscrupulous thief, adding insult to injury, calls the thing, let it turn what color it may. It tells us where we are geologically—somewhere in the upper zones of the Lower Silurian, in the Middle Silurian of some writers, somewhere near the horizon of the Utica slates of New York State. The numerous species of graptolithina are the letters on the margin of the Silurian ledger, but the record here is so crumpled and tattered as to dismay the scientific bookkeeper. It is enough, however, for us to find ourselves in the Lower Silurian.

The top of the black cliff bristles over with formidable whins (Ulex europæus); the trails of a bramble (Rubus fruticosus) hang tangled down to its very foot through the arms of a cousin dogrose, bellicose in war paint and hooked thorns. When this Siluria cannot nourish these full-armed warriors it suckles poison in crevice and cranny, digitalis is its darling; when it cannot have its sweet pets it sulks and grows nothing at all. To study with whole skin we move on a bit. Here where the cliff falls away, level with our eyes, based on the rock and velveted atop with moss, a naked layer of yellow clay 18 inches thick is before us. Not all yellow; between the moss and clay there is a thin dark lamina of humus green line of moss, black line of humus and yellow band of clay. This is an existing land surface; note it well, for in its keeping is a great part of the world's history, and, unlike Sancho Panza, its way is to let secrets rot in its keeping.

From the middle of the clay band pick out yon bit of slate matted about with living roots. See, there is a mat of intersecting graptoliths inside of it. Thus the dead zoophyte of a dead sea meets here the roots of ulex, a land plant living to-day. In the existing earth cap we have thus land life and sea life, the life of a remote past and that of the present time intermingled. And here, at least, time has no representation between the ancient and the modern life, or rather because time implies incessant action, no visible representation.

But this is the typical, the normal land surface; and as we find it so, we may expect to find ancient fossilized surfaces of the same kind. We may expect to find in them the older life of their rock base, as a rule marred and separated it may be by moon of time, the

later life of rock disintegration, for the most part terrestrial.

There are other surfaces, but they are exceptional and secondary, the result of the denudation of the fragile primary layer of disintegration. Below us we see a little canyon in which a stream carries away the Silurian earth cap within its reach to lay down the waste elsewhere. Everywhere this Silurian district around us is riven with dikes of Miocene basalt and elvanite. In the distance between mountain ranges of granite, upheaved most probably in the Miocene age, we catch sight of a gleaming floor winding far inland. To it goes the waste of all—Silurian clay slate, Miocene basalt and granite—to be formed into new beds. Nevertheless, the average areal condition of the land cap, though seamed and broken in on in every direction, is given by what is before us, that is, it is simply the subjacent rock which has undergone a process of organic reduction, of what I called rock zynosis in a previous article in this journal.

The specific character of the slate rock is its lamination. This we will content ourselves now with stating as a mechanical, almost crystallographic character. It obscures almost entirely every trace of original condition in the rock. As slate disintegrates or may be disintegrated, some such traces may reappear. Here before us we see every gradation between compact laminated slate and pulverulent clay. In places half-decayed slate runs up into the clay, and seams of clay extend down into the rock. The resultant clay has a peculiar aspect of its own; it is granular, nodular, resolves into little blocks which fit nicely into one another. It often contains pebbles, sand and bits of conglomerate which must have existed in the original slate. But the process of decomposition must be very unfavorable for such survivals.

Look now at the thin layer of vegetable mould at the top of the clay—it is intersected in every direction with filamentous roots which carefully keep within bounds. The favorites of Siluria, however, travel far for their living, adventuring their straggling roots down even to the underlying rock. This interlacement of roots is a distinctive though very variable character of land surfaces. Sometimes—never here—the surface is black with humus and matted together with roots; at other times it is a pure mineral clay which even moss refuses to take to.

A little farther on we can find the slate entirely decomposed, but bearing no trace of modern vegetation. In this spot the rock, still the same black slate, is so rotten that we must be careful not to bring down the house on ourselves. The cliff slopes away to a pool to end in grimy ooze and mud caked and cracked. This mud is in perfect continuity with the richly graptolithous slate, but without any change of position; it has completely lost the mineral character of lamination. It is the rock undisturbed, but in the last stage of decomposition. The concealed palimpsest of the slate may be dimly traced in this black mud.

I will indicate how this may be roughly done without entering on details of the transliteration. Cutting away with a knife pieces of the paste or gathering rough blocks of it dry without baking them in an oven. Drop a piece of the stuff thus dried into a glass jar of clear water—at once in shades of gray and black pencilings we get a facsimile of the land cap we were looking at a while ago. As the lump crumbles away in the water, we see not only the peculiar packed granulation of the clay structure, but pebbles, some rounded, others angular; some distinct, others glued together in bits of natural looking conglomerate. Like the heroine in every good novel, their attitude seems firmness itself, only to astonish us by a sudden collapse. They are really as rotten as their surroundings, but in some cases I have managed to save them by a little manipulation from their natural weakness. We see penetrating among these and the nodules of clay black lines; sometimes blurred, sometimes quite distinct, representing the roots which traverse the modern land surface.

Often too we have black patches or blotches, reminding us of buried layers of moss or of underground fungi. I have some reason to think that some forms of the vegetation indicated lived in the soil rather than on it. This ancient Silurian surface was much richer in humus and carbonaceous material than its degenerate successor. The diffused blackness of these slates and shales points to a soil composed, to a great extent, of vegetable matter. The process whereby the modern soil is formed is attended with destruction of the old carbon trace.

It will be seen thus that this ancient Silurian clay slate, seemingly quite homogeneous, conceals an older form. That form is partially, at least, restored under some circumstances in nature and can perhaps be restored, too, by chemical processes. What the older form was in detail must rest for determination on experiment and observation; but as a preliminary I shall give some general considerations leading to the inference that it was primarily a land surface developed under the influence of vegetation, and as so developed became secondarily the subject of denudation in varied operation.

We take the typical land cap as simply the underlying rock undergoing decomposition without disturbance. As thus decomposed material, it is chemically altered; but we will pass over this primary step. When it begins to bear vegetation it undergoes farther chemical change, which can be understood as a current phenomenon. For one thing, the rock debris becomes mixed with the results of vegetable decay; this we may pass over too. The important point is the action of vegetation on the rock material itself. From that material the growing plant takes up every leading ingredient, except one; it takes up lime, silica and potash and insoluble form, leading to their removal and dispersion in the long run. The one exception is alumina, which enters to no appreciable extent into the composition of plant tissue. The ultimate effect, therefore, of secular vegetation is the accumulation of alumina in the soil. Wherever the underlying rock thus contains alumina the overlying soil is relatively much richer in alumina, provided plant life has had time to produce its effect. Thus on the granite the soil becomes richly aluminous, although of the two ingredients of the rock containing alumina, feldspar contains only 18 and hornblende 7 per cent. In limestone soils the differentiation of alumina is even more marked. That substance is

stated as the base of soil, but it is plant life that makes it the base. In the coal measures it was secular plant life that in the course of time made the great "underclays" and rootbeds we see; these were not the cause nor the means of that life, but its effect and result. The same influence of vegetation in "aluminizing" the land surface we can see everywhere in operation at the present day.

If animal life were able to fix from the ocean the vast series of limestone and cretaceous rocks, we may entertain the idea that plant life by its negative operation was adequate to build up the slates and shales, and if in one geological formation, then in all. If we must give this Siluria here to the ocean and its beds of alumina to chance, we may give *Monograptus gregarius*, too, back to the fairies.

Poyntz Pass, Newry, Ireland, October 10, 1894.

A NEW STRAWBERRY.

RECENT number of the *Gardeners' Chronicle*, London, gives an account of a new variety of strawberry which had been sent for inspection by Mr. J. R. Stevens. The fruits are of a pale red color, lobulated and depressed, with a shining appearance and seeds deeply sunken. The flavor excellent; pulp solid and highly perfumed. The variety is considered a good one for early forcing. From the firmness of texture of the pulp, the *Chronicle* thinks it should make a valuable strawberry for market growers and others who are obliged to transmit their produce by road or rail. The foliage sent with the fruit was rather remarkable for its small size and short leaf stalks.

MOLASSES UTILIZATION IN CATTLE FEEDING.

OWING to recent changes in the legislation of European beet sugar countries, efforts are made to dispose

50 per cent. in weight of the fodder, of whatever elements it may consist.

A very important condition is that the molasses during mixing be sufficiently warm to thoroughly combine with the oil cake or beet cosettes, or whatever other product is used. When beet residuum is used, the fodder should consist of three pounds molasses and five and a half pounds of dried diffusion cosettes; the combination is complete in a few minutes, and should be then dried. If to be fed immediately to cattle, the mixing could be made as required.

Already on several European markets a product is sold for stock feed; its composition is 60 per cent. molasses, 40 per cent. cocoa oil cake (contains 20 per cent. protein, 3 per cent. fatty substances, and 25 per cent. sugar), which is sold for a fraction more than one cent per pound. Another fodder is composed of 20 per cent. cottonseed flour, 40 per cent. palm nuts and 40 per cent. molasses.

Several factories undertake their own mixing, and the substance obtained contains 14 per cent. protein, 3 per cent. fatty matter and 50 cent. non-nitrogenous matter.

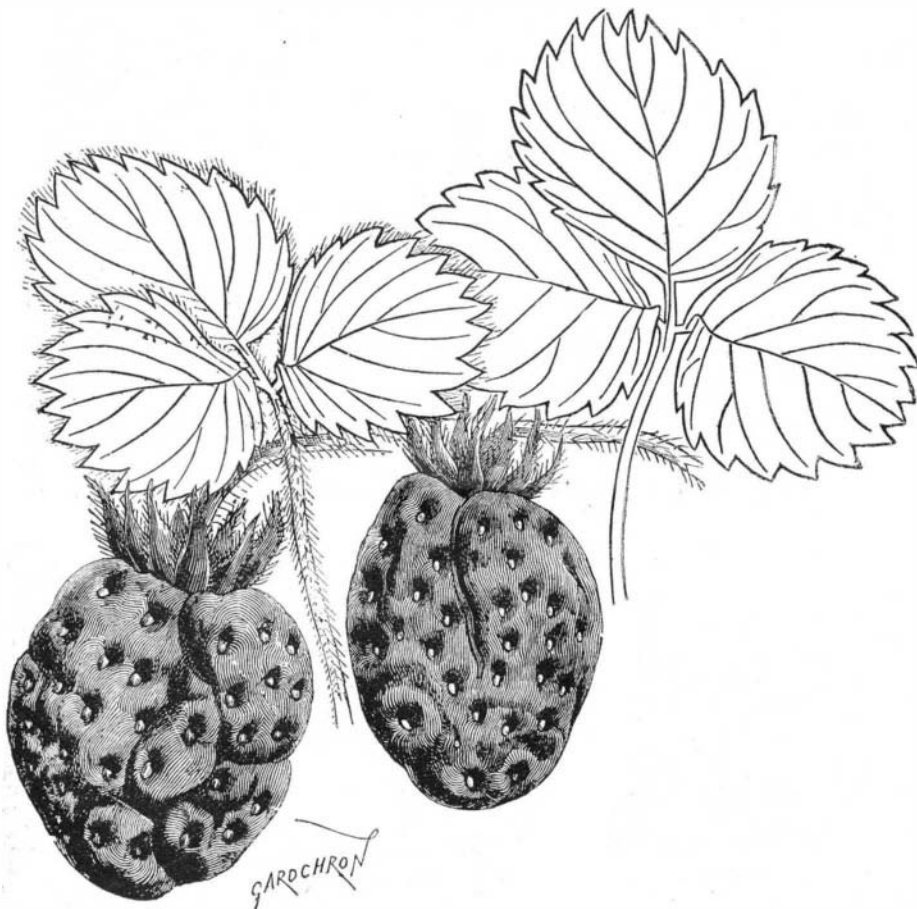
In every case the results by feeding these rations to cattle have been most satisfactory; the percentage has increased. Satisfactory results have been obtained in fattening sheep with a molasses ration. It is important to note that an astonishing success has been obtained by adding to the water given to cattle about 2 lb. molasses per diem and per head; they seem to drink this with avidity, and beneficial effects follow.—The Sugar Beet.

[FROM THE Kew BULLETIN.]

SAGO CULTIVATION.

(*Metroxylon Sagu*, Rottb. *Metroxylon Rumphii*, Mart.)

THE sago of commerce is a kind of starch prepared from the soft internal stems of certain palms natives



MR. STEVENS' NEW STRAWBERRY—COLOR PALE PINK.

of the residuum molasses to the greatest possible advantage. The idea of utilizing it for cattle feeding is not new, and has been practiced in many centers for twenty years past. Of late, however, the question has been discussed at the congress of the beet sugar manufacturers held in Dresden. When one considers the advantages to be derived, the great surprise is that it has not long since been generally adopted, as the economies resulting from the practice are numerous. Beet molasses contains a large proportion of the salts extracted from the soil by the beet during its development; and when fed to cattle and the resulting manure subsequently used, the fertility of the land is maintained for an almost indefinite period.

In many farming districts of France and Germany there prevails a natural prejudice against feeding molasses to cattle; and fact after fact pointing to the advantages to be derived seem to be of little avail. However, in the United States, but slight effort has been made toward convincing farmers of the importance of giving the subject a fair trial. To meet every possible objection that might be offered, the cattle-feeding associations of the country should take the matter in hand, and the results, we are convinced, would astonish them. We are pleased, from issue to issue, to record any attempts made. In the mean time we shall give herewith a few hints as to the best practices discovered and in what the most successful rations consist.

Some years since Prof. Maercker, after a series of extended experiments, concluded that the maximum of molasses to be fed per 1,000 lb. live weight and per diem was 3 to 4 lb. for oxen and 2½ lb. for milch cows. These limits have frequently not been adhered to, and many complications have followed. Of late it is urged that a special molasses fodder be used; it consists, besides the residuum, of some absorbing medium. In these compounds molasses frequently represents 60 per cent. of the total. Experts now say, however, that a far better proportion is to have one of molasses to one of the other substances, that is to say,

of the Malay Archipelago, Borneo, New Guinea and possibly of Fiji. The word sago or sagu is said to be Papuan for bread.

The are two well-recognized species of sago palms. The smooth or spineless sago palm (*Metroxylon Sagu*) is specially abundant in Sumatra and adjacent islands. It does not reach so far eastward as New Guinea. In North Borneo it is known as *rumbia benar*. Wet, rich soils, especially at the base of mountains, are its favorite localities. This species is regarded as the principal botanical source of the sago received in Europe.

The thorny sago palm (*Metroxylon Rumphii*) is found further east than the other species. It is plentiful in New Guinea, and in the Moluccas and Amboyna.

Both sago palms resemble each other in general appearance, but the latter is a smaller tree, and it has its leafstalk and the sheaths enveloping the lower part of the flower spikes armed with sharp spines from one-half inch to about one inch long. It has, moreover, decided littoral tendencies, and is abundant along the shores of many small islands forming a dense impenetrable belt. In North Borneo the thorny sago palm is known as *rumbia berduri* or *rumbia salak*.

Some sago is obtained from the sugar palm (*Arenga saccharifera*) after the plant is exhausted of its saccharine juice. The sago palm of India is *Caryota urens*.

The farinaceous part of the trunk of old trees is said by Roxburgh to equal the best sago from the Malay islands. In China, Japan and Florida, sago, differing in character of the starch grains from palm sago, is obtained from species of *Cycas* such as *C. revoluta* and *C. circinalis*. The commercial importance of the latter is very slight.

The cultivation of the true sago palms is entirely confined to the Eastern Archipelagoes. The plants are difficult to grow elsewhere, and it is improbable that the industry will extend beyond its present limits.

Both species of *Metroxylon* are monocarpic and die

after the seeds are ripened. The life of the plant lasts for about fifteen to twenty years, at the end of which period the terminal inflorescence is formed. In spite of the abundance of flowers, very few fruits are produced; these occupy two or three years in ripening. The propagation of these palms is usually effected by means of suckers or stolons formed round the base of old trees.

An interesting account of sago cultivation in Province Dent in British North Borneo is included by Governor Creagh in the report on the Blue Book of Labuan for 1893. [Colonial Reports, No. 122, Annual 1894.] As the subject has not hitherto been dealt with in these pages, the report, which has evidently been carefully prepared on the spot by Mr. J. G. G. Wheatley, is reproduced for general information:

A REPORT ON SAGO CULTIVATION IN PROVINCE DENT.

The sago palm, from which is manufactured the well-known sago flour of commerce, resembles in appearance the coconut tree. The former is valued for its trunk alone, the nuts are useless and the tree dies if allowed to fruit.

VARIETIES OF SAGO PALM.

1. There are only two kinds of sago palm which are cultivated, the "*rumbia benar*" (true sago) and the "*rumbia berduri*" (the thorny sago), also known as "*rumbia salak*." In appearance, both are the same, but on close inspection the stems of the latter, to which the leaves are attached, known as "*pallapa*," will be found to be covered with bunches of thorns about one and one-half to three inches long.

MODE OF PLANTING.

2. Sago grows chiefly on damp ground subject to floods at certain times of the year. If grown in swamps, less sago is produced and the trunks do not attain as great a height as when planted on clayey, damp soil subject to floods periodically. Once planted, the tree withstands floods and brackish water, but in the latter it does not grow as fast and the trunks are small. Sago is planted chiefly by suckers sent out by the parent tree, which are carefully cut off under ground. In swampy ground, the shoots are planted out at once, but in other localities the shoots are tied together in bundles and placed in wet, muddy ground until they have begun to send out roots, when they are planted out in holes twelve inches deep, one foot in diameter, and four to six fathoms apart. No earth is placed about the roots, but the plants are supported in an upright position by two sticks fixed on either side. The earth gradually fills the holes during rains and floods.

One man with an assistant can plant three hundred plants a day. After this, further attention is generally unnecessary for a year, and in some cases two years, when the jungle growth is cleared around the growing tree. Some planters regularly clear around the roots and cut away suckers if they are too abundant. *Rumbia berduri* is preferred to the *rumbia benar*, chiefly because the wild pigs do not attempt to destroy young plants, on account of the thorns. In planting *rumbia benar*, fences have to be made to keep out the pigs, which are very destructive. *Rumbia berduri* is also reported to produce more raw sago, but the quality of flour is the same in both species.

Each tree produces from four to five pikuls of raw sago (one hundred and thirty-three pounds = one pikul), being at the rate of one pikul per fathom of trunk. Both trees grow to the same dimensions, twenty-four to forty-two feet in height, and one and one-half to three feet in diameter at the base of trunk.

The sago palm is not subject to any disease, but, if a deep cut is made at the base of the trunk close to the earth, the pith is attacked by large maggots, which gradually eat their way into the center of the tree, and in three or four months destroy the whole trunk. This is a favorite way of paying off a grudge among the natives. The sago tree takes from five to seven years to mature, according to the nature of the soil. During the third year, the plant begins to send out shoots. These grow up with the parent tree and in time give out suckers. If these are allowed to grow too freely, they form a dense thicket around the mature trunks and give a great deal of trouble to the workers. Every year each clump produces a large number of workable trunks. During the fifth year, the parent tree is ready to be cut down. In the meantime, the young shoots are rapidly developing, and in the seventh year probably three or four trees are ready, and so on, so that the sago tree, once planted, continuously supplies the planter with logs without giving him any trouble as regards their cultivation.

The natives compare their sago plantation to a herd of cattle, and it would be difficult to reckon the number of logs that each clump may have produced in the space of forty or fifty years. When the sago tree is allowed to flower, the pith begins to diminish, and, if the mature trunks are not cut down regularly, the whole clump gradually deteriorates and the trees become stunted bushes, instead of growing to the usual height. Nothing of the sago tree is lost. The trunk supplies the sago; the leaves and stems are largely used by natives for building purposes, the former for roofs and the latter for partitions and walls of houses, which, when properly constructed, are very neat looking and durable. The top shoot makes an excellent vegetable, while the trunk, when split in two longitudinally and the pith scooped out, is used as a boat to transport the raw sago which has been extracted from it. The bark when taken off makes excellent fuel, and an enterprising Chinaman who employs an engine for rasping sago logs uses this as a substitute for fire wood.

The present price of sago flour at Singapore is \$2.55 per pikul. The Chinese traders buy the raw material at from \$1 to \$1.20 per pikul, according to the market price at Singapore, and, after allowing for the cleaning of the raw sago and washing it in the factories, there remains a profit of at least 50 cents per pikul to the Chinese manufacturers. The freight from Labuan to Singapore is 22 cents per bag of one hundred and fifteen catties = one hundred and fifty pounds. A royalty of 6 cents per pikul is charged on sago flour exported from Province Dent to Labuan when the Singapore price is below \$2.50, and 8 cents when above that