This latter, though without doubt very effective in fern that was at all reluctant to burn, was far too extravagant until converted to a kind of blowlamp by fitting a burner head somewhat like that of the Hauke Burner. As such it is by far the most effective torch yet used.

The burning was continued as long as conditions warranted; early in the spring it was possible to get in as much as two weeks continuous work if the rain held off, but as the summer advanced much shorter favourable periods occurred. In the hottest part of the summer it was usual to get in only two or three days burning after rain and then work would have to be suspended until the next fall. When burning was suspended the bulldozer driver continued making firebreaks and the few labourers were easily placed elsewhere.

The system is now in its second season and though as yet there has been no severe test of the protection afforded, we can at least watch any approaching scrub fire with some sense of security. It seems far better to proceed along the lines indicated than suddenly to have to rush men and equipment to deal with any neighbouring fire which may spring up in condition of extreme fire hazard. Once the burning off has been done we feel that we are fairly safe for three years. Any outside scrub fire which occurs during that time is in some measure looked on as beneficial—heretical view—for it means two or three more years of security in that locality.

TEAK GROWN IN WESTERN SAMOA

By H. R. ORMAN

Introduction.

During the 1939-45 War, the Forest Products Branch of the New Zealand State Forest Service, undertook, as part of its war programme, the investigation of various Pacific timbers in addition to its normal routine investigation of New Zealand ones. Such timbers as Fiji kauri (*Agathis vitiensis*), coco-nut (*Cocos nucifera*) and various tropical woods from the Solomon Islands area were examined and reported on. One of the timbers to be investigated in 1940 was teak (*Tectona grandis*) grown in Western Samoa, and it is considered that the possible appearance on the market of a limited supply of this wood from a source as close as Samoa will probably arouse some interest. Planting of teak has been carried out on other Pacific Islands including Fiji, but only in recent years, and some 20-30 years will have to elapse before timber is available from these sources.

A number of large plantations in Western Samoa are concerned principally with either coco-nuts (some of the largest planted areas

in the world) or cocoa, while small plantations of bread-fruit and bananas are grown for local consumption only. Until 1914 when a New Zealand Expeditionary Force occupied Western Samoa, most of these plantations were controlled by that great octopus of the Pacific, the famous D.H. and P.G. (der Deutschen Handels und Plantagen Gesselschaft der Sudsee-inseln zu Hamburg) usually called for short the "German Firm." Presumably it was this firm that initiated the planting of teak in Western Samoa, and from the reported age of the oldest trees, planting must have commenced about 1910. It is worthy of note that before the first European war, the Germans were purchasing regularly one ton of teak seed from Burma for planting in the colonies which they then possessed in East Africa. The large, previously German-owned coco-nut and cocoa plantations are now under the control of the New Zealand Reparation Estates, and the planting of teak seedlings has apparently been continued by them since the occupation of Western Samoa.

The teak in Western Samoa has been planted extensively as a shelter tree, more for shade than wind protection, in the large cocoa plantations; it has also been planted as an ornamental shade tree on many of the roadsides. In Samoa, teak, although in its native habitat a deciduous tree, is peculiarly suitable as a shade tree, due to the "dry" season being relatively wet with a high atmospheric humidity, resulting in the teak not going completely out of leaf. Teak is not planted in the coconut plantations as a shade tree, although it is rumoured that it has been tried as a "break" about coco-nut plantations for intercepting the "rhinoceros" or coco-nut beetle when in flight.

Apart from the privately owned cocoa plantations, which plant teak as a shade tree, there are on the Reparation Estates plantations some 20,000 trees ranging in age from 30 years down to year-old seedlings. Thirty-year-old teak trees attain 2 ft. in diameter with logs up to 15 ft. in length. A rough estimate gave 200,000 ft. b.m. of standing teak available in 1940. Practically no local market is available, though some sales have been made at 32/- per 100 ft. b.m. at stump. No difficulty should be experienced in extracting the timber as most of the plantations are connected by good roads to Apia.

Description of Timber.

A teak log was extracted from the Lafi Plantation, some seven miles from Apia, and shipped to Wellington where exhaustive tests were carried out by the Forest Products Branch of the State Forest Service. The log was slightly "piped," a defect reported to be present in about half of the trees felled in Western Samoa. The tree had a greyish bark not deeply furrowed and flaking off in long thin shreds. The lower end of the log was slightly buttressed rendering conversion more difficult and costly.

In the green condition, the timber is a light grey colour showing little differentiation between sapwood and heart. Air-dry sapwood is almost white in colour ; it forms a zone 1-2 in. deep. The heartwood is dull yellow when freshly cut, but after several hours exposure to the air seems to undergo oxidation, turning to a rich golden brown. When sawn or worked, the timber has a distinctive unpleasant odour, a specific characteristic ; but the aromatic oil from which it supposedly arises in the Burma teak was not so obvious, the surface of the timber being smooth to the touch rather than greasy. The timber works with moderate ease by hand and machine tools, but its dulling effect on their cutting edges is considerable. This is due to the deposition in the wood cells of mineral substances, mainly silica, from the sap, the silica content being nearly as high as that found in Burma teak, namely 14.6% of the ash (ash percentage 1.7). A good finish can be obtained if the tools are kept sharp ; the wood takes nails fairly well, but pre-boring is preferable.

The heartwood is resistant to decay under severe conditions of exposure, while the sapwood is non-durable. The timber seasons with a minimum of checking, splitting or warping. Shrinkage from a green to an air-dry condition is slight : tangential 1.12%, radial 0.64%, and volumetric 1.85%.

Salient features of its miscroscopic structure as revealed by the transverse section are :

(a) Vessels mainly solitary or in radial groups of two, oval, tylosed ; maximum tangential diameter 0.21 mm., number per sq. mm. 6-12 ; growth rings are indicated by larger size and grouping, radially and tangetially, of vessels.

(b) Wood rays multi-seriate (5-6 cells wide), one vessel diameter apart, cells containing abundant mineral inclusions.

(c) Wood fibres forming homogeneous bands between rays, walls fairly thick.

(d) Wood parenchyma mainly paratracheal.

In longitudinal tangential sections the wood rays are very abundant and prominent, 6 or more per mm., maximum height 1 mm. but usually 0.44-0.66 mm. ; the fibre bands and vessels are sinuous (between rays) ; vessel segment length 0.18-0.35 mm.

Strength Properties of Timber.

The specific gravity is practically the same as that of Burma teak, but the rate of growth is faster, with 3 rings per inch compared with an average of 10 in Burma teak. Strength properties in bending are moderately high, although not quite equal to those of the Burma wood.

Small deviations from straightness in the grain are due to small inter-grown knots at intervals of approximately 3½ ft. The single log upon which this description and test results are based had a grain

which was markedly interlocked. This characteristic property of the timber probably accounts for the test figures being much higher than those of Burma teak in compression perpendicular, hardness, shear, tension and cleavage.

Tabulated below are figures derived from tests on small clear specimens of green teak grown in Western Samoa ; Burma figures are included for comparison.

Average Mechanical and Physical Properties of Green Teak from Western Samoa and Burma.

Property		Samoa Teak	Burma Teak
Moisture content—per cent		88.7	51.8
Nominal specific gravity (weight oven-dry, volume at test)		.599	.598
Weight per cubic foot—green ...	lb.	70	57
Weight per cubic foot—air-dry ...	lb.	42.8	43
Shrinkage—green to ovendry—			
Radial—per cent		2.18	2.3
Tangential—per cent		3.09	4.2
Volumetric—per cent		4.71	6.8
Static Bending—			
Fibre stress at limit of proportionality	lb./sq. in.	6,920	7,090
Modulus of rupture	lb./sq. in.	11,310	11,435
Modulus of elasticity	lb./sq. in.	1,187,000	1,673,000
Work to limit of proportionality ...	in. lb./cu. in.	2.28	1.70
Work to maximum	in. lb./cu. in.	12.76	9.3
Total work	in. lb./cu. in.	22.95	27.1
Compression parallel to grain—			
Fibre stress at limit of proportionality	lb./sq. in.	4,492	4,075
Maximum crushing strength ...	lb./sq. in.	5,440	5,870
Modulus of elasticity	lb./sq. in.	1,626,000	1,937,000
Compression perpendicular to grain—			
Fibre stress at limit of proportionality	lb./sq. in.	1,647	1,055
Hardness—			
Radial	lb.	1,630	1,045
Tangential	lb.	1,681	1,030
End	lb.	1,431	915
Shear parallel to grain			
Maximum shearing strength—			
Radial	lb./sq. in.	1,547	1,045
Tangential	lb./sq. in.	1,629	1,170
Tension perpendicular to grain			
Maximum tensile strength—			
Radial	lb./sq. in.	1,017	525
Tangential	lb./sq. in.	1,153	695
Cleavage—load to cause splitting			
Radial	lb./sq. in.	462	
Tangential	lb./sq. in.	520	

As a local basis for comparison northern rata (*Metrosideros robusta*) is the wood most closely related in mechanical strength properties (green condition) to teak grown in Western Samoa. When it is realised that the relative air dry (12% M.C.) weights are respec-

tively 55 lbs. and 43 lbs. per cubic foot, the very particular merit of this teak timber is apparent. A word of warning must be added : the properties tabulated for Samoan teak are the results of tests made upon a single 7 ft. log (instead of five logs from separate trees) at the butt of a tree (instead of butt to 16 ft. for 2 trees and 8 ft. to 16 ft. for 3 trees). It may, however, be assumed that this departure from the accepted testing practice will not affect the conclusion that the timber merits consideration for some of those purposes for which Burma teak is peculiarly suited.

Summary.

1. Western Samoan teak is available in 15 ft. logs with a diameter of 2 ft. ; a rough estimate in 1940 gave 200,000 ft. b.m of standing trees available.

2. Access to the teak is by good roads, and no difficulty should be experienced in extracting the timber. Practically no local market is available, though some sales have been made at 32/- per 100 ft. b.m. at stump.

3. The timber is attractive, durable and seasons with a minimum of checking, splitting and warping ; the shrinkage is also very slight. Using the comparative standard strength terms, Samoan teak can be classed as being very strong in bending, and very strong in compressive strength. It is also very hard, stiff and of high resistance to shock.

4. Its uses should be very similar to those of Burma teak. Chiefly these would be for shipbuilding, especially for the decks, and for constructional work in exposed places. Use in railway-carriages would be worthy of consideration, particularly as it does not set up corrosion in contact with metals. It is well suited for high class joinery, flooring, interior fittings, doors, window frames and furniture.