

# EFFECT OF FERTILISERS AND COVERS ON GROWTH OF YOUNG RUBBER. IV

BY

W. B. HAINES

The following report summarises the more recent results on areas under the control of the Soils Division at the R.R.I. Experiment Station. The original planting was  $4\frac{1}{2}$  years old at the time of the latest measurements. Interesting results with rubber newly planted on plots which have long been under various covers are also included.

## BLOCK 6. MANURIAL EXPERIMENT.

This manuring experiment shows no change from the position indicated in previous reports (This Journal Vol. 4, No. 2, p. 126; Vol. 3, No. 2 etc.). The following table gives the average girth (at 1 foot) of the various plots, together with the increments in the last three six-monthly periods. Each figure is the mean of six plots (and each such plot value is a mean of some 80 trees).

TABLE I

*Block 6. Girth in inches at 1 foot.*

		A	B	C	D	E	F
		Control	Cattle manure	Com- plete inor- ganic	N only	N & P	P & K
6-monthly increments	3 - 3½ years	2.83	2.96	2.94	2.89	2.98	2.65
	3½- 4    ,,	3.22	3.61	3.20	3.14	3.28	3.19
	4 - 4½    ,,	2.92	2.63	3.06	2.85	2.82	2.88
Present girth at 1 ft.		22.96	24.36	23.85	23.09	23.14	23.06

The singular uniformity shown in these figures is reflected in the calculation of the standard error of the experiment as only 1.20 per cent.

## BLOCKS 7 AND 8. COVER CROPS.

A similar table is given for the more recent history of Blocks 7 and 8. The layout does not contain any replication of plots so

that a proper estimate of significance has not been attempted, but the lie of land is very even and some guidance may be obtained from Block 6 which is contiguous and of the same planting.

TABLE II

*Girth and 6-monthly increments in inches at 1 foot*

		Control	Lamtoro		Control	Crotalaria		Control	Calapogonium
			Pulled	Un-pulled		Pulled	Un-pulled		
Block 7	years								
	3 - 3½	3.08		3.10	3.05		2.59	3.11	2.70
	3½ - 4	3.17		3.76	2.91		3.30	2.99	2.97
	4 - 4½	2.61	2.82	1.90	2.80	3.21	2.23	3.00	1.98
Present girth		24.32	23.40	22.71	23.16	21.75	20.55	23.78	20.81
Block 8	years								
	3 - 3½	3.57		3.59	3.36		2.86	3.22	2.86
	3½ - 4	2.80		3.37	3.75		3.50	2.96	3.49
	4 - 4½	2.27	4.54	2.72	1.56	2.99	2.80	2.45	2.45
Present girth		23.62*	25.09*	24.25*	32.62*	23.10	21.53	23.18	21.19

As previously noted the *Lamtoro* plots have reached a level with the controls, while the *Crotalaria* and *Calapogonium* plots remain a little behind. Block 7 with timber left lying is a little behind Block 8 which was clean cleared. None of the differences are large. The only outstanding feature of the recent measurements is the large increase in the growth of that area in Block 8 which had *Lamtoro* growing at first, but from which it was pulled rather less than 2 years ago. This response stands alone, however, and will require verification from future figures.

#### BLOCK 11. BELUKAR (SECONDARY JUNGLE) PLOTS

Since the last report it has been decided to further sub-divide Block 11 by clearing a strip in the middle, consisting of 6 rows in the slashed half and 6 rows in the unslashed half. The fact of retarded growth seemed so clearly established now that it was important to see how far and how quickly the young trees would recover when the competition of the undergrowth was removed, and the trees given full opportunity to make use of the indubitably good soil conditions which had been maintained.

Table III shows the recent increments in growth and the present mean girths at 1 foot.

\*The trees from which these averages are calculated are alternated with buddings

TABLE III

Block 11. *Girth measurements in inches at 1 foot*

Planting Distance			Unslashed	Cleared	Slashed
22ft. x 22ft.	Increment {	3 - 3½ years ...	0.97		1.15
		3½ - 4 ,, ...	2.55		2.82
		4 - 4½ ,, ...	1.29	1.97	2.25
		Present girth ...	17.20	17.35	18.53
22ft. x 11ft.	Increment {	3 - 3½ years ...	0.51		1.16
		3½ - 4 ,, ...	2.20		2.77
		4 - 4½ ,, ...	1.07	1.59	2.10
		Present girth ...	14.76	17.10	17.69

The values for other clean weeded plots of the same date of planting, as shown above, are between 21 and 24 inches, so that Block 11 is now very definitely behind. The slashed half has been selectively weeded for over a year and contains only a mixed flora of plants regarded as useful.

The feature of Table III that is specially interesting is the very low increment between the ages 3—3½ years. This is the period which contained the first true wintering, and it is apparent that the temporary weakening of the trees gave the competing undergrowth an advantage of which full value was taken. This explanation receives additional support in the fact that, where the undergrowth was uncontrolled, the effect was most severe (one third of the development which was normal for the period on clean weeded plots.)

It should be remarked that, during the few months since clearing the middle strip, the trees there have improved most remarkably in their foliage, and it is to be anticipated that this will be reflected in additional growth over the next period of measurement.

#### BLOCK 17D. COVER CROPS.

Part of this block was originally planted in strips of covers without rubber and, after four years, stumps from pod-picked seed of various proved clones were planted in these covers. Only such disturbance was made in the cover as was necessary for the planting. Alternate plants were assisted over half the area by placing well

rotted Adco artificial farmyard manure (made on the Station mainly from grass cuttings) in the holes. The stumps came away very uniformly and now, after eight months, show the following very interesting differences in growth (Table IV). The *Vigna* has always grown so very sparsely that this plot may, to all intents and purposes, be regarded as a clean control.

TABLE IV  
*Stumps planted in well established covers*

Covers (in order of performance)	Mean height in feet of stumped seedlings			
	Treated half of plots			Benefit of Adco (per cent)
	Mean of all	Mean of manured	Mean of unmanured	
<i>Crotalaria</i> ...	7.44	8.08	7.63	5.9
<i>Lamtoro</i> ...	6.87	7.54	6.67	13.0
<i>Tephrosia</i> ...	6.80	7.48	6.68	12.0
<i>Calapogonium</i>	6.74	7.32	6.57	11.7
<i>Mikania</i> ...	6.51	7.03	6.68	5.1
<i>Vigna</i> (very poor growth) ...	6.35	6.88	5.85	17.5
<i>Pueraria</i> ...	6.33	7.03	6.42	9.2
<i>Centrosema plum.</i> ...	6.20	6.81	6.03	13.0
<i>Mimosa</i> ...	6.13	6.59	6.38	3.2
<i>Centrosema pub.</i> ...	4.82	5.07	4.90	3.7

The effects to be noted in these figures can be partly attributed to the cumulative effect upon the soil of the covers standing for four years. But, in the writer's opinion, they may be mainly attributed to the present competitive and other effects due to the cover being already in possession. Thus the maximum effect of manuring is on the practically clean *Vigna* strip, where there is no competing root system to take the extra food from the rubber. On the other hand the smallest effect from manuring is in the *Mimosa* and *Centrosema pubescens* plots, where the cover is most vigorous and has not only taken most of the advantage of the Adco fertiliser, but has also kept the rubber back to the greatest extent.

The shrub covers are by far the best, which may be partly due to their better and deeper root action on the soil, but also partly to the better shade protection afforded the young rubber plants. *Centrosema* comes out of the test very badly, and stresses the comment often made by the writer when inspecting young clearings, namely, that when one sees an exceptionally fine and vigorous creeping cover one should balance one's admiration by a critical examination of the rubber trees lest one unwittingly overlooks the retarding effects of competition which may be present.

The next table (V) gives the relative growth of the young rubber which was originally planted further along these same strips of cover at the same time as the covers, and so has grown in conjunction with them from the commencement. In consonance with the results elsewhere we find that clean weeding (i.e. the plot where the *Vigna* was a failure) has given the best growth, *Lamtoro* is very little behind with *Crotalaria* next, while the worst growth of all is on the *Centrosema pubescens* plot. The values for the seedlings are the most reliable since the figures for the buddings still show the disturbing effects of the trees where successful budding was late.

TABLE V

*Mean girth in inches at 1 foot from ground*

		<i>Buddings</i>	<i>Seedlings</i>
<i>Lamtoro</i>	...	6.57	12.63
<i>Tephrosia</i>	...	5.67	10.51
<i>Crotalaria</i>	...	5.80	11.40
<i>Mimosa</i>	...	5.23	10.60
<i>Mikania</i>	...	4.85	10.25
<i>Pueraria</i>	...	4.65	10.22
<i>Calapogonium</i>	...	4.67	10.41
<i>Centrosema plum.</i>	...	5.43	10.95
<i>Centrosema pubes.</i>	...	5.17	9.79
<i>Vigna</i> (almost clean)	...	6.71	13.03

Further evidence of the retarding effect of *Centrosema pubescens* is provided in Block 17A. Here the trees have received a regular treatment with a complete chemical manure. On the clean weeded plots the girth at three years of age is 15.15 inches, which is exactly the same as the cattle manure plots in Block 6 at the same age. On the *Centrosema* plots the retardation of tree growth is 24.3 per cent. for interplants established six months after the cover, and 12.5 per cent. for plants established at the same time as the cover,

## BLOCK 19. CULTIVATION EXPERIMENT

Table VI gives the position of the cultivation plots now, after 14 months, as compared with the position of the same plots at the time of the previous report (7 months). The experiment has 9 plots—three treatments in triplicate, on ground which was previously in grass. In each series of measurements the figures (mean of three plots) are given in terms of the grand mean as 100.

TABLE VI

*Cultivation Experiment (original planting 3½ years old)*

Treatment	Girths compared with grand mean as 100		
	Previous report 7 months from first cultivation		Now 14 months after first cultivation
	First Buddings	Interplants	
1. Grass left	97.0	96.2	93.2
2. Dug & weeded	102.8	97.8	104.8
3. Dug periodically with regeneration of grass in between	100.4	106.1	99.5

The standard error of the second series of measurements was 1.93 per cent. So far the clean weeded plots are doing best, while the grass plots show a tendency to fall behind. Of these two results the effect of grass may be judged significant, while the effect of weeding is only barely significant.

## BLOCK 23. CATCH CROPS

On this block are a large number of plots (17 were used in the results reported) where the rubber is interplanted with tapioca, pine-apples and coffee. The layout does not permit of very critical comparisons, but the following summary of the last measurements is sufficiently interesting to be put on record. The effect of tapioca is very damaging to the rubber not only in growth but in the incidence of root disease. The rubber grown in conjunction with coffee gives the best result so far, no doubt because the conditions there have been nearer to clean weeding exposure than in any other case,

TABLE VII

*Growth of 2½ year old rubber with interplanted crops, compared with grand mean (=8.13 inches girth at 1 foot) as 100*

Legume cover ( <i>Centrosema</i> and <i>Pueraria</i> )	...	101.1
Coffee	...	116.2
Tapioca	...	76.4
Pineapples	...	106.5

## SUMMARY

A concise statement is given of the more recent results at the R.R.I. Experiment Station on the effects of fertilisers, covers, cultivation methods and catchcrops on the growth of young rubber.

In all cases the early effect is for the cover to reduce growth of the rubber by its competition for food, and this effect has been the most prolonged in the case of the plots with a natural cover.

*Centrosema pubescens* does not justify its popularity in these comparisons, while shrubby covers like Lamtoro are showing the more favourable results.