Draw-bar Tests at Peradeniya.

T. H. HOLLAND, M.C., M.S.E.A.C.,

Manager, Experiment Station, Peradeniya;

and

L. LORD, M.A.,

Economic Botanist.

Introduction.

THE primary object of these tests was to determine the draw-bar pull of various implements and it must be emphasised that the tests were not designed to discover the most economic implement for any particular purpose. Although the quality of the work of the various implements was noted it was not possible on this occasion to determine the time taken to plough a unit area. This information will be obtained from further trials. However, from observation and a study of the data supplied by these tests, it has been found possible to form certain general conclusions as to the most suitable implements for the conditions under which they were tried.

Tests were carried out for three types of work:—

(i) dry land ploughing.

(ii) first ploughing on paddy stubble.

(iii) mud ploughing for paddy.

The factors to be taken into consideration in determining the most suitable implement to be recommended include cost, draught, quality of work, and work done in a given time. Data on all except the last factor will be found in the following tables:—

Table I.

Dry land ploughing. Old paddy plots ploughed and disced about a month before the trials and covered with a light growth of weeds, mostly couch grass. Soil—sandy-loam.

IMPLEMENT	Approximate price in Ceylon. Rs. Cts.	Average draw-bar pull. Cwts.	Average depth of work. inches.	REMARKS.
A. PLOUGHS.				
1. Ransome's All Steel " Victory " Plough ...	45·00	2 5/8	5	Excellent work. Turns a neat furrow. Mould board scours well.
2. Cooke's Light L.N.O. Plough with one wheel ...	128·00	3 3/8	5	Very fair work. Mould board not scouring well.
3. Ransome's " Cyprus " Light Steel Plough ...	66·50	2 to 5	3 to 6½	The work was unsatisfactory. It was found impossible to set the plough to work at an even depth: the plough dug in and ran out of the ground alternately.
4. Howard's " Sinhalese " Plough ...	34·00	2 3/8	4¾	An imperfectly turned furrow owing to difficulty in steering the plough.
5. " Meston " Plough ...	11·00	1 3/8	3½	Not very satisfactory. It is difficult to keep the plough straight and maintain an even depth.
6. Molegode Plough ...	7·50	1 3/8	3	The plough stirs the soil well but does not turn a furrow.
7. Disc-harrow ...	180·00	3¼	-	Unploughed land. Discs set at extreme angle and therefore giving heaviest draught. Stirred surface soil well.
8 discs (full setting)				
,, (full setting) ...	,,	3 1/8	-	After ploughing. Stirred soil well.

Table I. *(Contd.)*

IMPLEMENT	Approximate price in Ceylon. Rs. Cts.	Average draw-bar pull Cwts.	Average depth of work. inches.	REMARKS.
Disc-harrow (contd.) 8 Discs (full setting) ...	180·00	3½	-	Unploughed land after one discing.
,, (half setting) ...	,,	2½	-	Unploughed land. Work almost as good as with full setting.
,, (half setting) ...	,,	2½	-	After ploughing. Work almost as good as with full setting.
,, (half setting) ...	,,	2¾	-	Unploughed land after one discing. Work almost as good as with full setting.
B. CULTIVATORS, Etc.				
8. Planet Junior Cultivator fitted with 3 tines and 2 small mould boards ...	70·00	3	2½	Unploughed land. The cultivator broke up the soil fairly satisfactorily.
,, ...	,,	1¾	-	After ploughing. The cultivator stirred the soil satisfactorily.
9. Planet Junior Cultivator fitted with 5 tines ...	70·00	1¾	2½	Unploughed land. The cultivator broke up the soil fairly well.
,, ...	,,	1½	-	After ploughing. The cultivator stirred the soil satisfactorily.
10. Burmese Harrow with 5 teeth ...	6·00	1¼	-	Unploughed land. Little penetration of the soil until the implement had gone over the land several times.
,, ...	,,	1 7/8	-	After ploughing. The implement satisfactorily stirred the soil. A man stood on the harrow.

Table II.

Ploughing for paddy. First ploughing on stubble. Fields lightly flooded. Soil—clay-loam.

	IMPLEMENT	Approximate price landed in Colombo. Rs. Cts.	Average draw-bar pull Cwts.	Average depth of work. inches.	REMARKS.
1.	Ransome's All Steel " Victory " Plough ...	45 ·00	1 7/8	5	Excellent work; an even, well turned furrow.
2.	Ransome's Wood-beam P.I.K. Plough with wheel ...	47 ·60	1	3½	A neat, well turned furrow; not so wide as that turned by the " Victory " plough. Good work.
3.	Howard's " Sinhalese " Plough ...	34 ·00	2¼	5	Turns a good furrow, but not so good as the " Victory," and the plough is more difficult to adjust and control.
4.	" Meston " Plough ...	11 ·00	1¾	3½	Work inferior to that performed by the P.I.K., and plough more difficult to control.
5.	Molegode Plough ...	7 ·50	1 5/8	3	Furrow not inverted. The soil is stirred in the same manner as by a village plough though perhaps slightly more effectively.
6.	Kandyan Plough ...	5 ·00	1	3½	Fair work.
7.	*Dewath* Plough ...	5 ·00	¾	1	Ploughs do not penetrate, and are unsatisfactory under the conditions of these trials.
8.	*Badawath* Plough ...	5 ·00	½	-	
9.	Low-Country Plough ...	5 ·00	⅞	1½	Not such good work as the Kandyan.

Table III.

Ploughing for Paddy. Second or mud ploughing in fields previously ploughed and now flooded. Soil—clay-loam.

	IMPLEMENT	Approximate price landed in Colombo. Rs. Cts.	Average draw-bar pull Cwts.	Average depth of work. inches.	REMARKS.
	A. PLOUGHS.				
1.	Howard's "Sinhalese" Plough ...	34·00	1 1/8	-	Turns soil well. Work not very deep.
2.	"Meston" Plough ...	11·00	2 1/8	-	Turns soil fairly satisfactorily.
3.	Ransome's light "Cyprus" Plough ...	66·50	-	-	Quite unsatisfactory. It is difficult to set the plough at the correct depth. It either digs in or slides along the surface.
4.	Ransome's Wood-beam P.I.K. Plough ...	47·60	1¼	-	Good work. Turns over the soil well.
5.	Molegode Plough ...	7·50	2	-	The plough only stirs the soil and does not turn it over. Does slightly better work than the Kandyan plough.
6.	Kandyan Plough ...	5·00	1 5/8	-	Pull rather variable. No furrow is turned.
7.	*Dewath* Plough ...	5·00	1	-	Work inferior to that of the Kandyan plough. Soil and weeds tend to collect under the beam owing to abrupt fall above tongue (see Plate I).
8.	*Badawath* Plough ...	5·00	1 1/8	-	Work better than *Dewath* plough but inferior to Kandyan.
9.	Low-Country Plough ...	5·00	⅝	-	Work inferior to Kandyan.
	B. CULTIVATORS, Etc.				
1.	Burmese Harrow with 5 teeth ...	6·00	2¼	-	Implement used after first ploughing in place of a plough for the second and third ploughings. A man stood on the harrow. Satisfactory work done.
	,, with 3 teeth ...	6·00	1 7/8	-	A man stood on the harrow. Work satisfactory.

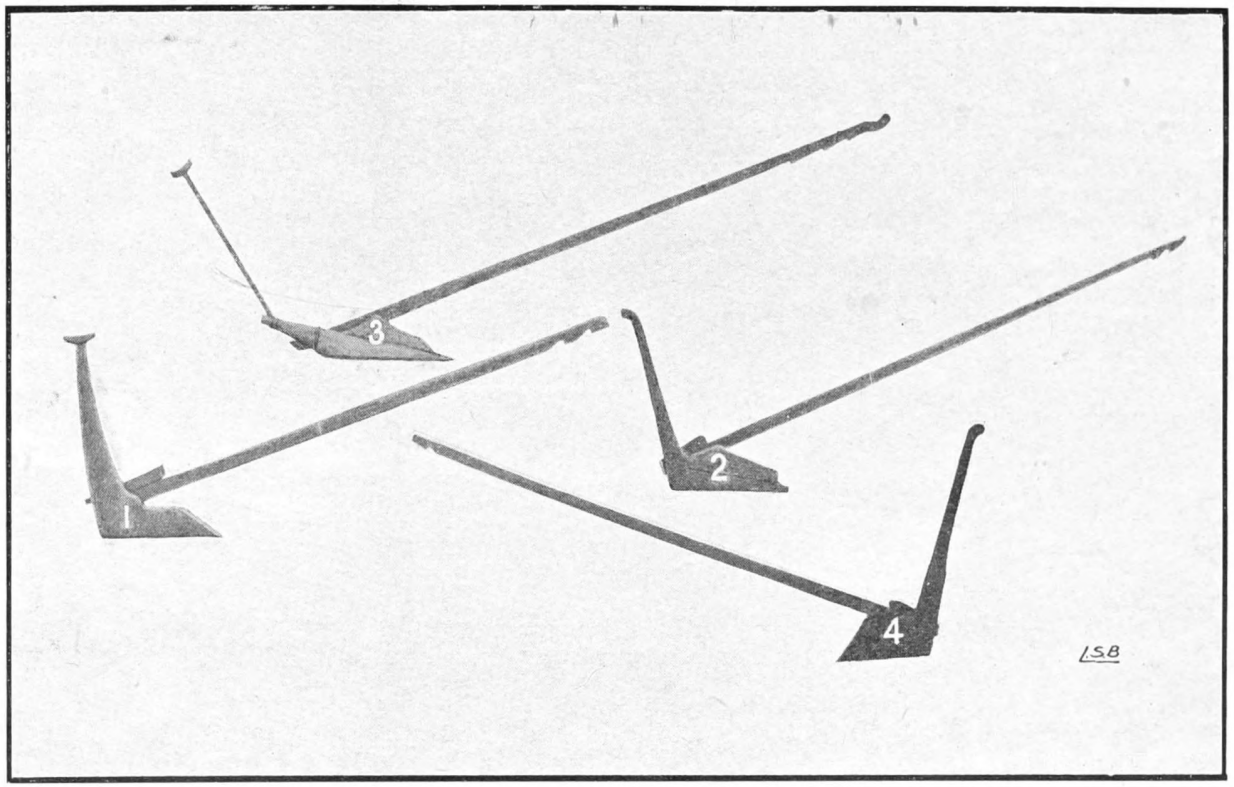


Photo by *L. S. Bertus*

Types of Sinhalese Ploughs.

1. The Kandyan
2. The *Dewath*
3. The *Badawath*
4. Low-Country Plough.

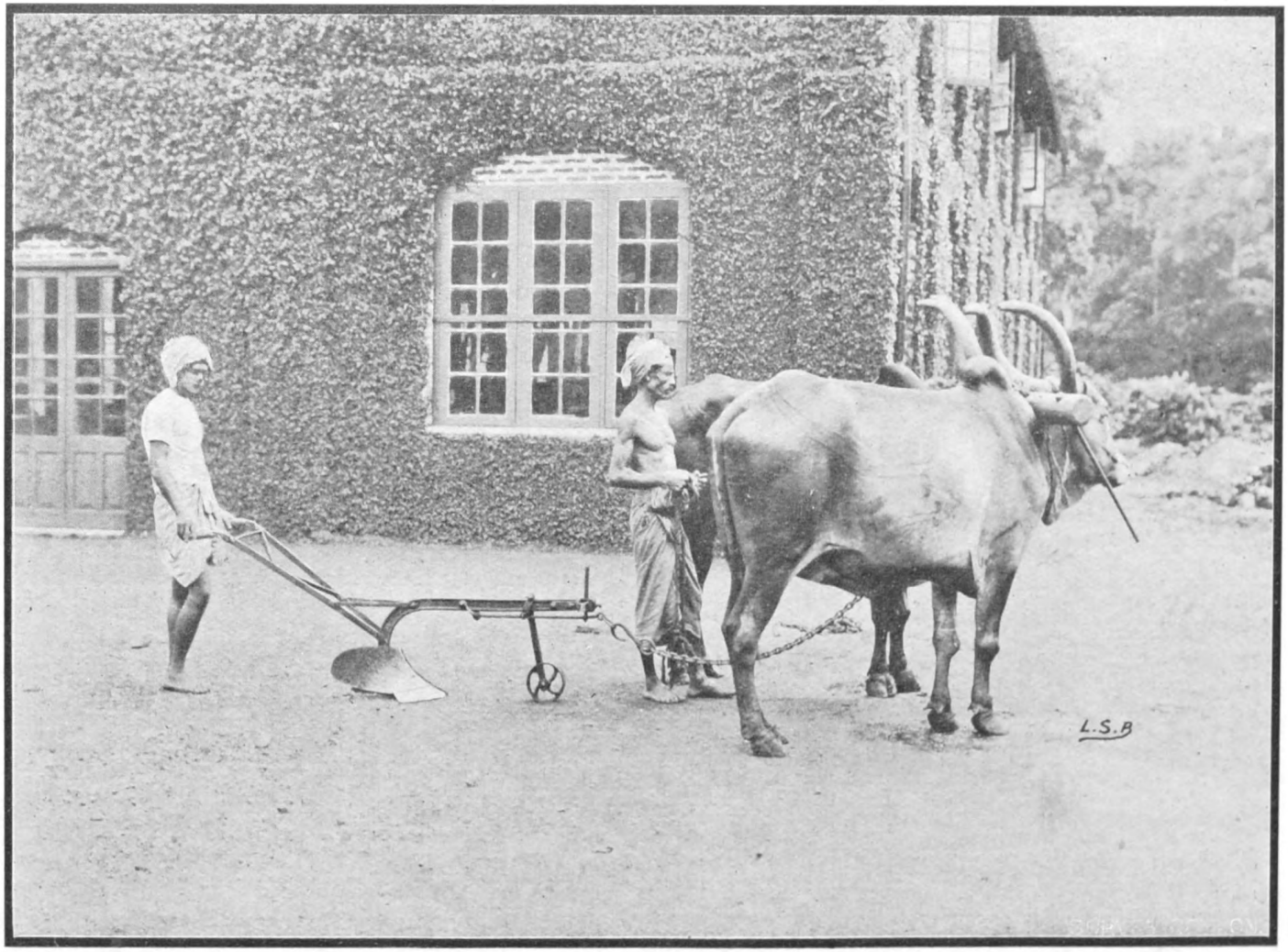


Photo by *L. S. Bertus*

Ransome's "Victory" Plough.

Discussion of Results.

1. **Dry Land Cultivation.**—The use of agricultural implements for dry land cultivation in Ceylon can be considered under the following headings:—

(1) Dry ploughing for paddy and other crops in the Jaffna Peninsula, and certain districts in the North and East of the Island.

In the dry districts it is most desirable that all weed growth and green material found on the surface of the land should be turned in, thus increasing the amount of humus in the soil and increasing its capacity for retaining moisture. The plough found in these trials to achieve this most efficiently was undoubtedly the " Victory;" and for the work done the draught was low.

It has been found that a pair of Indian bulls of the type generally imported into the Jaffna Peninsula can pull a " Victory " plough without undue fatigue, and where such a pair of animals, or a good pair of buffaloes, is available, and the cultivator can afford the cost of the implement, the " Victory " can be confidently recommended.

With regard to the other ploughs: the cost and draught of the Cooke's L.N.O. rule it out of the discussion.

The work done by Howard's " Sinhalese " plough was inferior to that done by the "Victory," and though the cost is less the draught is almost the same.

Owing to the small size of the mould board of the "Meston" plough and the difficulty of keeping this plough straight and at an even depth the inversion of the furrow was imperfect. The draught however is sufficiently low to enable the plough to be pulled by a pair of local animals and the work may be said to be an improvement on that done by a country plough.

The Molegode plough differs from the Village plough by the addition of an iron plate designed to perform the functions of a mould board. Owing to its small size and shape this plate does not invert a furrow. The plough however stirs the soil rather more effectively than a country plough and the cost and draught are not very much larger.

Another plough, Ransome's Wood-beam P.I.K., was tried, but owing to the fact that the share was very worn and new shares were not obtainable locally, records were only taken of its performance on paddy land.

The Burmese harrow was scarcely able to penetrate unploughed land, but for use after ploughing in the preparation of a seed bed the work done was little inferior to that of more expensive types of cultivator.

(2) **Cultivation on Coconut Estates.**—Proprietors of coconut estates could generally afford a rather more expensive implement and a more powerful type of draught animal. Here again the effective burying of weed growth is desirable and for this purpose the " Victory " plough can be confidently recommended.

For shallow cultivation a disc-harrow is probably the most effective implement. The cost is high and the draught considerable, but it is to be noted that the work done with the discs set at half the extreme angle was practically as effective as at the full setting. Even at the full setting a pair of good Indian bulls can pull a disc-harrow with eight discs all day.

A Planet Junior Cultivator will also do such work fairly effectively and the cost of the implement is considerably less. The draught however is higher in proportion to the size of the implement and the rate of covering the ground.

(ii) **First Ploughing for Paddy.**—An examination of the results in Table II. shows that one modern plough, the P.I.K. has no greater draught than the local Kandyan plough in spite of the fact that the P.I.K. plough does more and better work. It ploughs a wider furrow and inverts the furrow, the latter fact being very important when large quantities of weeds or green manure have to be buried. The Molegode plough, an improved model of the local plough, does better work than the Kandyan plough but does not invert the furrow. The draught was 1 5/8 cwt. compared with 1 cwt. of the Kandyan and P.I.K. Its chief merit is cheapness. The " Victory " plough does the best work of all the ploughs tested and will be even better than the P.I.K. for ploughing in green manures. Its draught was 1 7/8 cwt.—Howard's " Sinhalese " plough though doing good work had a draught of $2\frac{1}{4}$ cwt. which is probably on the high side for use with village cattle. The " Meston " plough does better work than the " Molegode," is slightly more costly and had 1/8 cwt. more draught.

However high the quality of the work of any plough is, a plough is useless unless its draught is such that it can be pulled by the cattle available. It is difficult to determine with any great accuracy what pull an average pair of village cattle can exert, but ordinary buffaloes at Anuradhapura have little difficulty in pulling a three and five-toothed Burmese Harrow.* The draw-bar pull of a three-toothed Burmese Harrow in similar soil at Peradeniya is 1 7/8 cwt. The Molegode plough which can be drawn by village cattle, has, in mud ploughing, a draw-bar pull of 2 cwt. (see Table III.). There is ground, therefore, for assuming that village cattle can cope with a draught of 2 cwt. although for continuous work about $1\frac{3}{4}$ cwt. might be a safer estimate.

* Since this article was written the " Victory " plough has been successfully used with buffaloes.

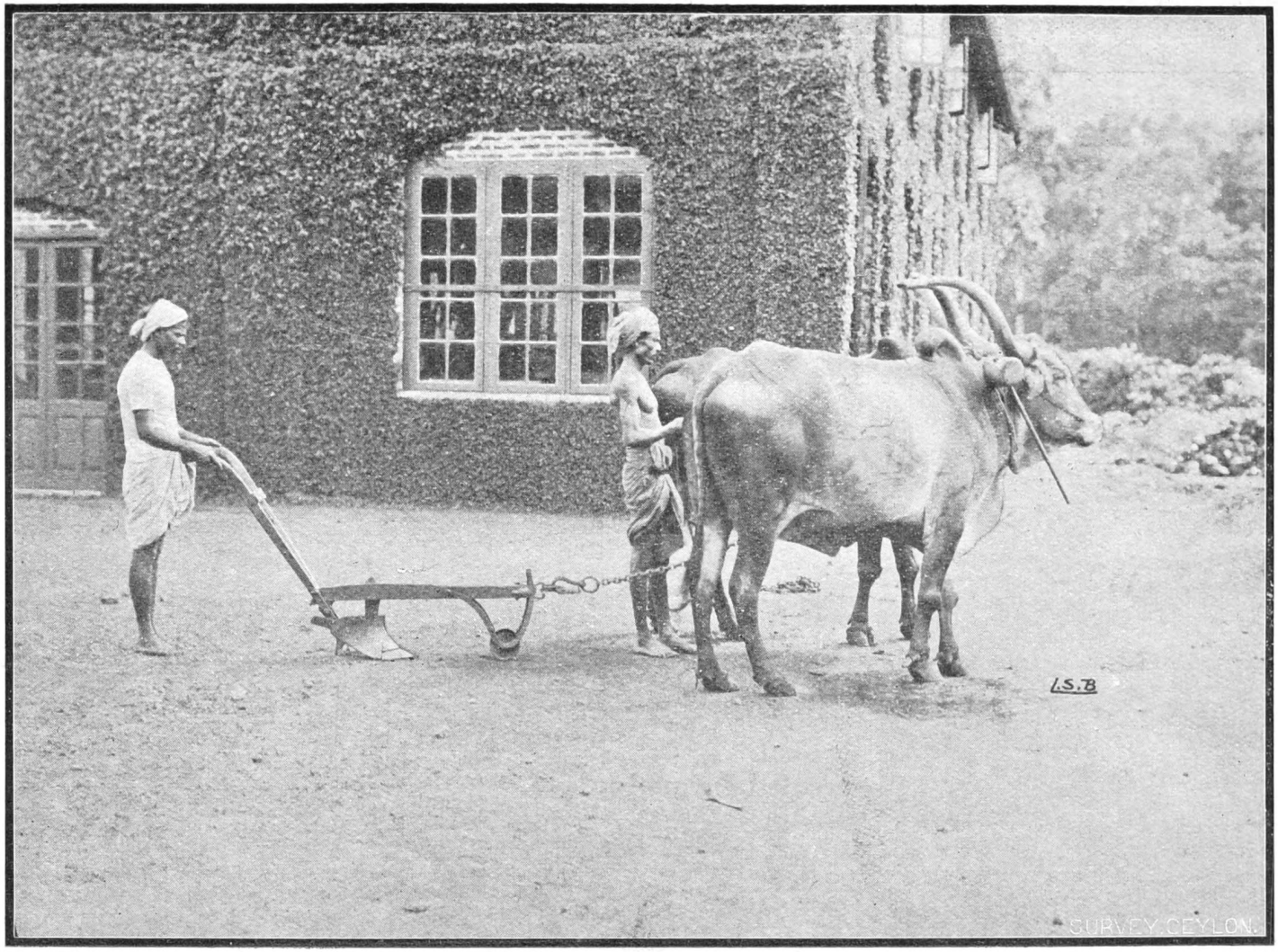
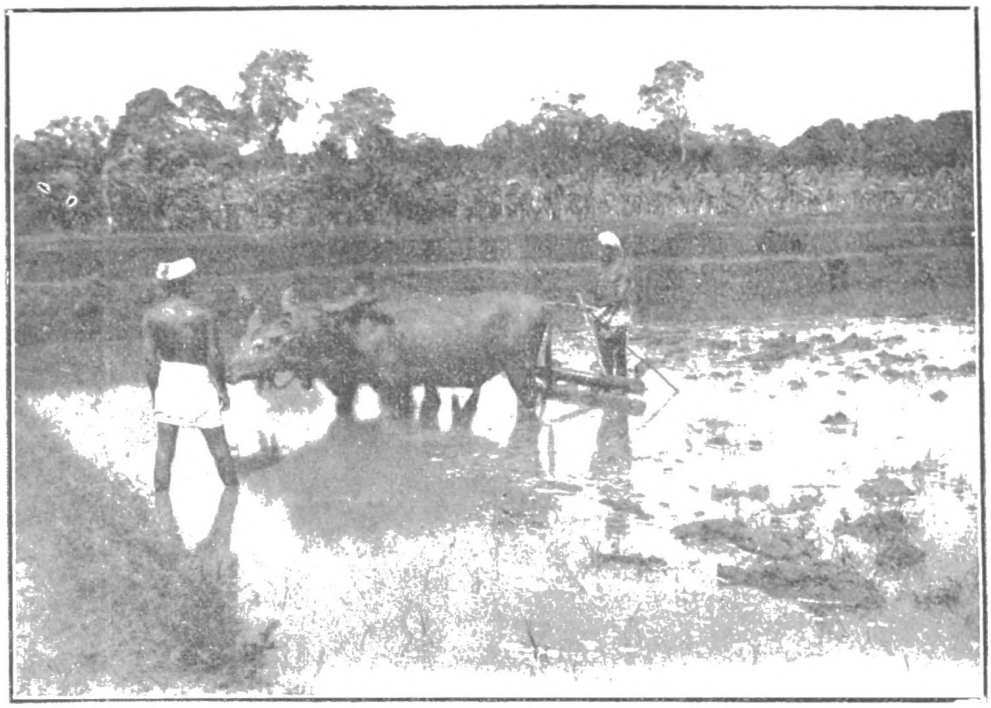


Photo by *L. S. Bertus*

Ransome's P. I. K. Plough.



Harrowing with Buffaloes.

Ploughing with "Victory" Plough
and Buffaloes.

The best plough to use in the first ploughing for paddy depends not only upon the draught and upon the cost of the plough but also on the kind of work to be done. That is to say a plough effective in breaking up a clean stubble is not necessarily effective for ploughing in green manure. Considering the cost, draught and quality of the work, the P.I.K. would appear to be the best implement to use in the first ploughing for paddy if green manures or a heavy weed growth have to be turned in. Where particularly good cattle are available and a heavy crop of green manure is to be dealt with the "Victory" plough would be more effective and would do the work quicker. The cost of both these ploughs is high for the ordinary cultivator.

The problem of determining the best plough for breaking a clean paddy stubble is more difficult. The problem is really to determine the most economical plough and to do this the method of the subsequent preparation of the land must be considered. In the first place, it may be laid down that ploughing with a modern plough gives no increase in the yield of paddy if the subsequent puddling is thoroughly carried out.

An experiment was laid down in Burma in 1924-25 to determine the effect of ploughing for paddy with an English furrow-turning plough called the "Jat." In reporting the experiment Watson* says:—" So far as the results go they indicate that the method of ploughing has practically no effect on the final yield of the crop." But he goes on to say that—" In paddy cultivation here the cultivation given after ploughing is so thorough that small differences in ploughing are swallowed up almost entirely, but continual deeper ploughing should show some effect later. Meanwhile, the chief advantage of using an improved plough is that in practice it does reduce the number of harrowings required subsequently and effects a saving of eight to twelve annas per acre in the cost of cultivation."

For Ceylon it may be said that a Molegode or a local plough will be efficient in breaking a clean stubble so long as a thorough subsequent puddling is carried out by means of a Burmese Harrow. Without the use of such an implement the P.I.K. plough is recommended; even with the use of a harrow the P.I.K. plough may reduce the cost of subsequent puddling and thus prove to be more economical than the local plough. The strong weed growth in Ceylon paddy-fields suggests that more efficient preparation of the seed-bed with the object of reducing weed growth would be repaid many times in the increased crop obtained.

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* Watson, R. Report on the Hmawbi Agricultural Station for the year ended 30th June, 1925.

(iii) **Mud Ploughing.**—Of the different ploughs tested the P.I.K. was by far the most efficient. The low draught (1 1/8 cwt.) of Howard's Sinhalese plough was unexpected as previously its draught was greater than the P.I.K. The "Cyprus" plough which is successfully used in Upper Burma was found to be very difficult to adjust and was unsatisfactory in the conditions of the tests. The "Meston" and Molegode ploughs had the biggest draughts. The mud ploughing done by a local plough, if done frequently enough, will produce an excellent puddle but the work is slow. All that is necessary is to use some implement that will thoroughly stir and puddle the soil over the whole field. For puddling the extensive paddy lands of Burma a harrow is universally used and this has been introduced into Ceylon with success. In place of the one single furrow of the local plough it makes three or five furrows according to the adjustment and thus covers the ground much more quickly, and its cost is little more than the cost of a local plough. Doubts have been expressed as to the capability of village buffaloes to pull the Burmese Harrow but these are groundless. For the last two seasons village buffaloes have been used with Burmese Harrows at Anuradhapura for preparing a well puddled seed-bed. Where a strong weed growth has not been allowed to grow up after the first ploughing the writers recommend substituting the mud ploughings by a thorough wet harrowing with the Burmese Harrow Where there is a strong weed growth in consequence of the puddling (or mudding) of the fields having been delayed it will be necessary again to plough before harrowing.

Summary.—1. The results of draw-bar tests of various agricultural implements are tabulated and discussed.

2. For dry cultivation other than coconut estates the "Victory" plough is recommended where the cultivator can afford the price and has sufficiently powerful cattle.

3. The "Victory" plough is recommended for use on coconut estates for ploughing in heavy weed growth or green manures. For shallow cultivation the disc-harrow is the most effective implement.

4. For the first ploughing for paddy, if there is a strong weed growth or green manure to plough in, the P.I.K. plough is recommended for use with average village cattle. Where cattle are above average in size the "Victory" plough is recommended. If there is a clean stubble the P.I.K. plough or the local Kandyan plough followed by thorough subsequent harrowings, are recommended.

5. Thorough harrowing with a Burmese harrow is recommended as a substitute for the mud ploughings.