A STUDY ON FIELD TEST OF PLOWS AND DRAFT ANIMALS UED IN VIETNAM

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Most of the animal power tillage implements used in the Republic of Vietnam are drawn by a pair of cattle. The only exceptions are Quang Tri and Hue provinces which are closed to North Victnam, and a small amount of farmers moved from the North who are used to using the single-draft-animal. In Bien-Hoa area there are 40,000 North Vitnam immigrants who all use single-draft-animal. According to Vietnames agricultural statistics on 1964, the Republic of Vietnam has 589,994 head of water buffalo and, 1,279,960 head of yellow cattle, comprising a total of 1,869,624 head. The cultivated land in south Vietnam is roughly about 3,200,000 hectare. Using this figue, an average of one cattle takes care of 1.7 hetares of cultivated land or 3.4 hectares for a pair of cattle. Taiwan uses a single-draft-animal. The average hectares/cattle is about 2, which is insufficient to meet the need of the present intensive farming methods, with an average of 2.3 crops per year. This is why the power tiller has been introduced to meet this demand. If Vietnam will follow an intensive farming method, to keep the idle land to a minimum, and all crops can be planted on time, then the present amount of cattle are just about enough for using a single-draft-animal which gives a load of 1.7 hetares per single cattle. Using a pair of cattle with the same working capacity as a single draft animal means that lots of possible planting area is lost, and farmers carry a double burden for feeding cattle. Plowing is the heavies work in land preparation. If the draw-bar pull of plowing for an average size of single animal is no problem, there will be no problem for any other secondary tillage. Therefore this study is only limited to the plowing problem, trying to find the possibilities for improving the effeciency of plows as well as animal utilization.

Plows used in Vietnam

There are many different types of locally made plows used in Vietnam. According to the F. C. Ma report, all the local plows can be roughly classified into two kinds. The most popular one is the long beam plow for double-draft-animal use. The beam is about 3. meters in length and is directly hitched to the middle part of the double animal york. The typical construction is shown in Fig.1. Second is the short beam plow which can be attached to both double and single anmals, but in comparison with long beam plow it comprises a very small persentage of the total. An additional draw-bar pole, about 1.5 meters long is used for hitching the short beam plow to the double animal york, as shown in Fig. 2. All the local plows are made of wood with the exception of the share which is made of cast iron, but some of the moldboard seen in the Bien-Hoa area are made of cast iron also.

A number of imported plows can be seen in the Bien-Hoa area. They are the French Steel plow with double handle by using double draft animals (Fig. 3). and the Japanese

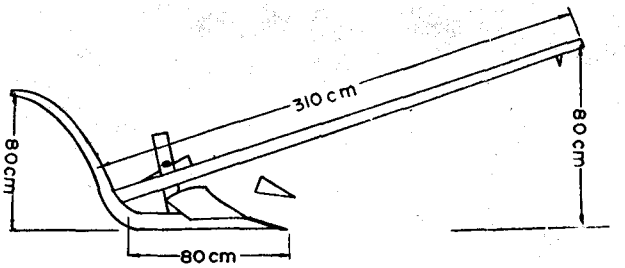

Fig 1. Local Long beam plow, the most popular one in Vietanm

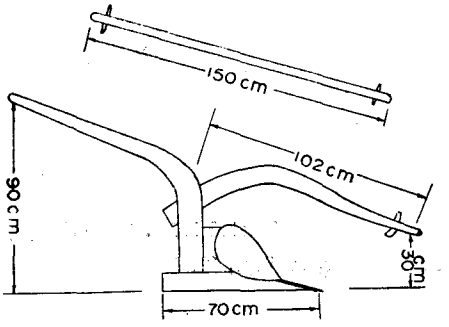

Fig 2. Local Short beam plow used in the south

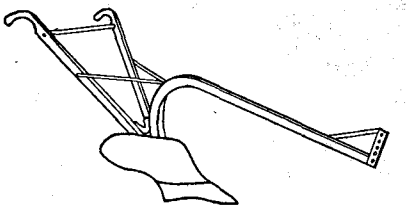

Fig 3. Imported French steel plow seen in Bien- Hoa area.

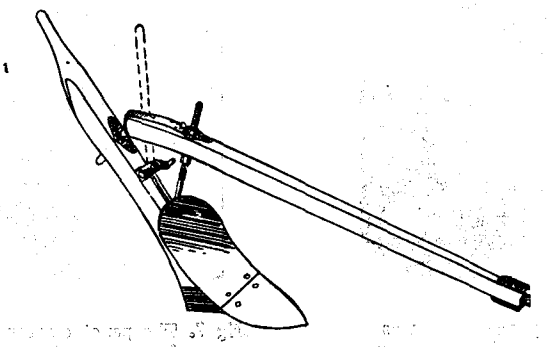

Fig 4. Imported Japanese plow Seen in Bien-Hoa area

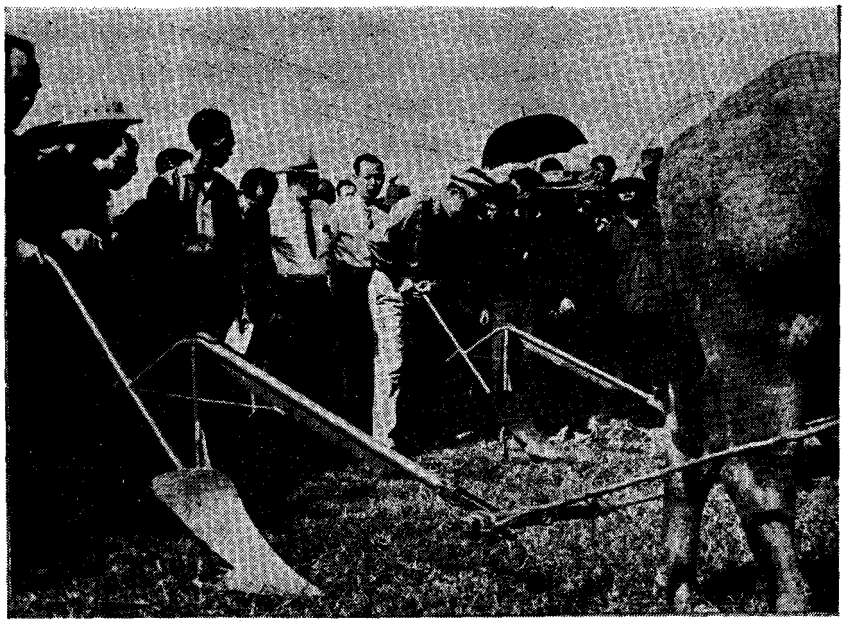

Fig 5. The Chinesce government donated NTU. Cheu-shang plow demonstration in Bien-Hoa provincee, on Sept, 29, 1964

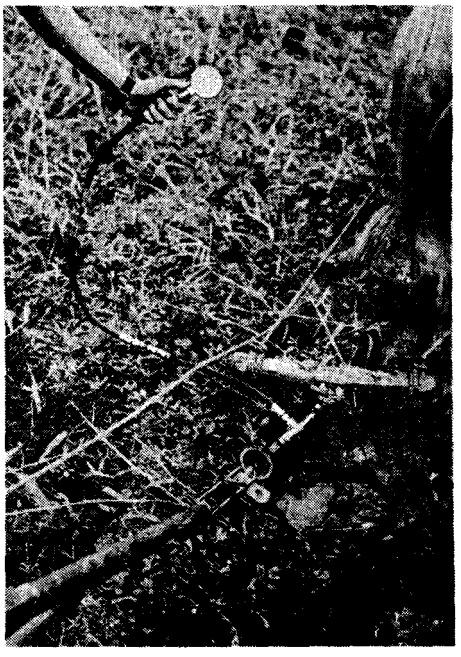

Fig 6. The Hydraulic dynamometer was used for measuring the draw-bar pull in the field test

Fig 7. The penetrometer was under investigation for testing the Soil hardness

wooden frame plow (Fig. 4). used by some north Vietnames immigrants, but the traditional Japanese side handle had been cut off. All the Japanese plows used in the Bien-Hoa area are drawn by a single animal. Recently the Chines Government donated 300 sets of NTU. plows (Fig.5) to the Republic of Vietnam. The NTU. plow is made of iron tube only 12.5 kgs in weight which was designed by the author, specially for tropical area use.

Field test

This test took place on a North Vietnames immigrant's farm at Bien-Hoa, which was selected by the Agricultural Division of the Bien-Hoa provience. Four kinds of plows were tested. They were the local long beam plow, with cast iron share and moldboard; the French steel plow; the Japanese plow and NTU. plow. The First three listed above were used plows with completely polished share and moldboard but wth less sharpened points. The NTU. plow under test was a new one with unpolished share and moldboard surfaces but with sharpened point. Two water buffaloes were used as draft-animals with an everage size of 500 kgs for each. Both of them belonged to one farm and had experience of working alone and as a pair. The field used for this test was of the sandy loam soil, 25m. × 20m. in area. The thickness of the top soil was 12 to 14 cm. with a penetration resistance of 20 to 30 kgs for the top soil and 50 to 60 kgs for the subsoil which had been mearsured by a 25 mm. in diameter and 60° cone shape penetrameter as shown in Fig. 6. The moisture content of soil was about 20%. each plow had been tested for four rows. The plowing speed, draw-bar pull needed and the cutting depth and width had been mearsured between a distance of 14 meters. The draw-bar pull was taken by a indicater type hydraulic cylinder dynamometer (Fig 7), continuous reading 15 to 20 points for each row. The speed was taken with a 30 sec. stop watch. The plowing depth and width had been taken 3 points on each row. The test results are shown in the table below:

Field plowing test results

No. of buffalo used	Kinds of plow	Plowing depth cm.		Plowing width cm.		Cutting section Ave. cm^2	Forward speed m/sec.	Draw-bar pull kg.		Draft resistance Ave. kg/cm^2	Power consumption Hp.
		Range	Ave.	Range	Ave.			Range	Ave.		
Two	VN. long beam plow	11-14	12	22-26	25	300	0.52	80-140	112	0.37	0.78
	French plow	11-12	11.5	—	30	345	0.58	100-120	109	0.315	0.84
One	Japanese plow	10-12	11.7	20-24	24	265	0.65	80-120	90	0.34	0.78
	Chinese NTU. plow	14-17	15.1	20-25	23	347	0.65	60-100	77	0.224	0.67

Test results analysis and discussion

1. The average plowing depth of the local plow,French plow and Japanses plow with thier original position of depth adjustment shown in this test was about 11-12 cm. which was also the depth used in plowing by the plow's owners. It should be noted that a deeper plowing in Vietnam should be encouraged for the purpose of increasing the soil productivity.

2. The best performance in this test was given by the NTU. plow with a deepest plowing depth of 15.7cm. and a largest cutting section area of 347 cm^2. but with the least draw-bar pull of 77 kgs and also the least draft resistance of 0.244 kgs/cm^2.

3. It appears an interesting result that the buffalo drafting alone had a higher speed than

buffaloes drafting in pairs, despite the heaver load carried by the single-draft-animal. This means that no over load was taken by the animal, otherwise the speed would be dropped. Accorking to observation, using a single draft animal gives more freedom than the use of draft animals in pairs, and also no harmonic problems are involved. In this test, the forward speed of buffaloes drafting in a pair was 0.52 to 0.58 m/sec., draft alone was 0.65 m/sec.

4. In Taiwan an average Hp. delivered by a buffalo for continuous working, 8 to 10 hrs a day is about 0.65 Hp. Acording to F. C. Ma report, in Vietnam the animals only work 6 hrs a day. The Japanese plow proved that the Vietnames buffalo working 6 hrs a day can deliver 0.78 Hp. This is still normal.

5. A continuous draw-bar pull capacity of an anmial is proportionate to its weight, roughly 10% to 20% of it. The size of animal used in Vietnam roughly varies from 400 to 600 kgs for water buffalo, and 250 to 450 kgs for yellow cattle. The buffaloes used in this test were about 500 kgs. The draw-bar pull of the Japanese plow had been tested, was 90 kgs which took about 18% of the animals weigt, the NTU. plow took 15%. Both of the plows were working within the single animal's drafting capacity.

Conclusion

1. The single-draft-animal farming method and deep plowing should be encouraged for reducing the farmer's burden and increasing the planting area and yield.

2. There was not any indication of over loading for the average size of Vietnames water buffalo to carrying an average draw-bar load of up to 90 kgs which will cover the most cases of loading for plowing, if an effcient single-draft-animal plow is used.

3. The NTU. plow gave the best performance and the least draft resistance of 0.224 kgs/cm^2 which takes only 60% of draft resistance produced by the locol long beam plow. This shows that the NTU. plow would be the best selection for single-draft-animal use.

4. There is no any technical problem to apply a single-draft-animal if, the top soil penetration resistance is under 40 kgs, the weight of draft animal is above 450 kgs, and the draft resistance is under 0.3 kgs/cm^2.

Sugestion

Wind and animal power are two rich natural resources common to Viet-Nam, both of them will bring to this country unaccountable wealth if they are utilized propperly. Fortunitly, the wind mill has alreeady been accepted by the farmers and is unmistakably recognized as the cheapest method for pumping irrigation water. We hope now, that the single draft animal and efficent impliments will also be recognized by the farmer and receive equal attention and support.

The following suggestios are given as references to show how this recognization and utilization might be best brought about.

1. The soil of most of the provinces along the east coast and the central part of Vietnam is of the sandy loam. This soil is soft enough for the aplication of the single draft animal plowing method. This would be an ideal area in which to introduce the above mentioned plowing method.

2. A 25 in. in diameter 60° cone shape penetrometer can be employed in extensive investigation, to determine other areas of applicability of the single draft animal plowing

If soil penetration is under 40 kgs it would pose no problem for the use of this method.

3. The primary draft animal should be the water buffalow, with attention directed towards his use and training. The heavier yellow cattle (above 400kgs) should be considered as a secondary power source.

4. All the young farmers and qualified young animals both who are no experience of plowing before, should start to train them using the new plowing method with high effecienct plow.

5. All the farmers of the North Immigrants can be served as a good trainer and demonstrator on using single-draft-animal farming as sugested by F. C. Ma.

6. Using an improved harness as sugested by Mr. Richard G. Kowel, and better feeding and care also will improve the animal strength.

Reference

1. F. C. Ma, 1963. Prelimiary Study of Farm Implements used in Vietnam. Plant Industry Series;No, 24, JCRR. Taipei, Taiwan, China.

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摘　　要

由於越南係採用双牛耕作，平均每對耕牛須負擔3.4公頃，與臺灣單牛耕作每頭耕牛只負擔2公頃相比顯然越南的耕牛係處於極端不足的狀態，使耕地不能充份加以利用，同時農民對耕牛的負擔也極重，故對改用單牛耕作之可能性頗有研究之價值。本研究爲一初步田間試驗之結果，俾供越南改良犁耕作業之一參考。

1. 使用平均體重500kg左右之越南水牛單獨犁耕，平均牽引力在90kg左右，前進速度在0.65m/sec之下並無超荷現象之感覺。如能使用一高效率之改良犁，此負荷量已足夠應付超南一般之犁耕情況。
2. 凡土壤之穿透阻力（使用60°，25mm之錐形穿透計）在40kg以下，耕牛之體重在450kg以上，犁之牽引阻力在0.3kg/cm² 以下，在越南使用單牛耕作不致有太多技術上的困難問題。
3. 越南沿海及中部各省均屬沙質土，其表土之穿透阻力不致超過40kg，爲推行單牛耕作之理想區域。
4. 越南之水牛與臺灣者無異，其重量約在400-600kg，可先行採用及訓練單獨耕作之需。
5. 在四種不同構造之畜力犁（越南長轅犁，法國犁，日本犁，臺大犁）之田間比較試驗中，以臺大犁之性能較佳，其牽引阻力爲0.224kg/cm²，僅爲越南長轅犁之60%，故供越南單牛耕作之需爲最佳之選擇。