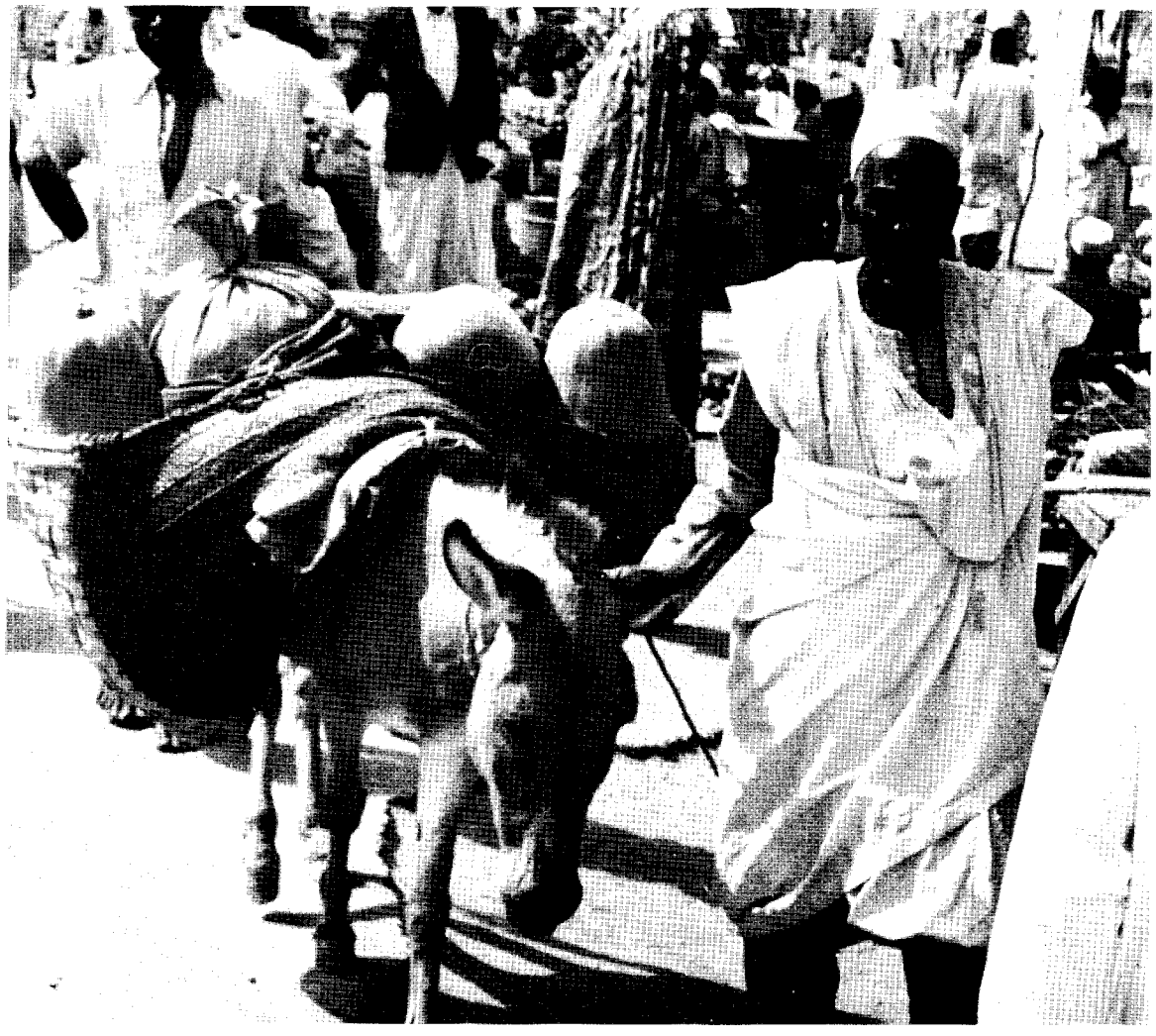

Section 10

Regional and Miscellaneous

Research on Cow Traction in Africa : Some Lessons to Be Learnt

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Abstract

This paper compares the conclusions drawn from ILCA's work on single-ox and cow traction in Africa with those drawn from surveys and farmers' experiences in South East Asia especially Thailand and Bangladesh.

The ILCA work shows cow traction to be apparently more profitable than single-ox ploughing and both better than pair-ox ploughing. This paper throws some doubt on these conclusions and indicates that cow traction may cause problems by requiring larger amounts of high quality feed. Also Asian experiences show that using poorly fed cows for draught work results in long term declines in fertility and milk production. Thus if only poor to medium quality feed is available the single-ox option may be the better one in Africa despite the fact that more cattle have to be kept overall.

Introduction

Cow traction is common in South-east Asia but not so in Africa except in Egypt and to some extent in the Sudan where barren cows are used. ILCA has started research on cow traction in Ethiopia with the objective of introducing it in areas where animal traction (AT) is already well developed. Similar research may be initiated in other areas such as the Sub-Humid Zone of West Africa where AT is currently being promoted. The objective of this paper is to review ILCA's research objective and strategy in the light of the experiences of cow traction technology development in South-east Asia.

ILCA's Research Experience

In the Ethiopian highlands, ILCA has tried to introduce two innovations; the single-ox plough and cow traction. It has been reported that oxen used as singles are able to cultivate approximately 70% of the land prepared by paired oxen. Therefore, the use of single oxen may allow 'poor farmers to improve their crop yield by planting earlier and to economise by keeping or renting fewer oxen' (ILCA 1986, p. 2-3). It is further argued that widespread use of single-ox ploughs would reduce the number of oxen needed to support food crop production, thereby increasing the feed resources available for each working animal (Gryseels et al. 1984).

Two questions emerge from these assertions. First, although the plough and harness used by a single ox is lighter than the one used by a pair, it is difficult to understand how a single ox can achieve 70% of the work of a pair of oxen of the same capacity. Such an improvement in technical efficiency would be considered revolutionary by any standard. Second, an earlier study reported that crop yields were not affected by the level of draught power owned or by the type of plough (single-ox vs pair- ox) used (Gryseels et al. 1984). So it is not clear how the use of the single-ox plough may lead to higher yield via early planting. For example, if a farmer owns a pair-ox plough, his available draught capacity will be 30% less than required, so early planting of all land will be out of the question. If he replaces his pair -ox plough by two single-ox ploughs, his available draught would be more than adequate, so early planting may be possible but he will need two ploughmen instead of one to operate such a system. Unless excess power can be sold in the rental market, the system is likely to be highly uneconomical for this farmer. Thus, the suitability and profitability of single vs pair-ox plough will primarily depend on the amount of land owned or cultivated. If land ownership is less than adequate to use 1.5 pair-ox ploughs, two single-ox ploughs may be more profitable.

In 1983, a 23-week on-station experiment to determine the effect of diet restriction on the work performance and body weight loss of crossbred and local Zebu oxen used as singles showed that feed restriction caused more weight loss to local oxen but there was no measurable effects on work performance (Astatke et al. 1986). However, farmers who tested single-ox ploughs in 1985 reported that the use of oxen as singles was

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constrained by the shortage of high quality feed during the dry season, especially for the first cultivation of the season, when the power required to draw the plough was at the limit of the capacity of a single-ox (Gryseels et al. 1984; ILCA 1986, p. 2-3). Feed scarcity is likely to be greater for smaller farms, so they are unlikely to benefit much from single-ox ploughs.

Cross-bred dairy cows used on-station for draught in 1982 and 1983 have shown that, when adequately fed, such cows can meet the draught requirement of a typical highland farm. It is, therefore, argued that cows can substitute for oxen and, in principle, reduce the aggregate feed demand of livestock enterprises. Thirty farmers in Debre Zeit area tested cow traction in 1985 but they reported that a reliable home-grown source of high quality feed would be required to make the innovation work effectively (ILCA 1986, p. 2).

Thus, it appears that in order to make both the single-ox plough and cow traction workable, feed constraints have to be overcome. ILCA has already responded in this direction by launching 'on- station research on forage legumes and legumes sown as relay crops in the regular crop cycle to provide additional feed' but large-scale adoption of such feed production technology has been considered 'unlikely in the next few years' (ILCA 1986, p. 2 and 5–6).

Assessments of the relative economics of different traction systems have continued in the meantime. Based on a survey in 1985/86 in Debre Zeit area, the relative economics of teff and wheat production using traditional pair oxen, single-ox and cow traction have been compared. It has been found that cow traction gave the highest labour productivity of both teff and wheat and the highest land productivity for wheat but the lowest land productivity for teff. Using coefficients from the same data set, a linear programming (LP) exercise also showed that compared to single-ox ploughing, cow traction gave twice as much labour employment, 6.8 times more land productivity, and 3 times more labour productivity. Compared to the traditional system, cow traction gave 1.7 times more labour employment, 3 times more land productivity and twice as much labour productivity. The conclusion derived from this exercise stated, 'the main constraints to the use of the traditional and single-ox systems were shortage of animal time during the cultivation period and the amount of arable land available. The shortage of animal time was most acute in the case of the single-ox technology. This constraint can be avoided by using cows as draught animals; the amount of arable land available set the limit on farm income when using cow traction. These results clearly indicate that, of the technologies tested, cow traction is the most efficient in terms of resource use and productivity and that further research on cow traction is warranted' (ILCA 1989, p. 68-71).

There are a number of pitfalls in the budgeting and LP exercise. An examination of the background data shows that the reported productivity differences had very little, if any thing, to do with the traction technology per se because, for example, in teff production twice as much was spent on fertiliser under the traditional and cow traction systems compared to the single- ox system, and in wheat production no fertiliser was applied under the single-ox system but 3.4 times more was applied under the cow traction system compared to the traditional system (ILCA 1988, p. 68-71). If cows and oxen are substitutes and are assumed to have similar draught capacities, why should the cow traction option give a different, albeit a superior, optimum solution in the LP exercise? Such a solution is feasible if cows are significantly more powerful than oxen but in reality the opposite would be expected. The other possibility is the inclusion of the value of milk in the cow traction option but nothing was said about the methodology of handling milk within the framework of the crop enterprise budgets. If a single ox is incapable of cultivating a given amount of land (possibly because its capacity is 70% of that of a pair of oxen), how can cow traction solve that problem, as has been concluded? Possibly by pairing the ox with a cow (assuming the farmer has one), thereby abandoning single-ox ploughing as a solution to the poor man's power problem but if so, what is the short and long-term price of such a solution?

A study (Agyemang et al. undated) conducted during 1981–83 on the effect of work on reproductive and productive performance of crossbred cows over two lactations found no significant differences between draught and non-draught cows but the draught cows actually performed inadequate amounts of work to allow any significant effect to occur. This led the authors to conclude that cows could be used for draught for some minimum period without any adverse effect. However, the period of only two lactations would be insufficient to draw any conclusion. The determination of the minimum amount of work and synchronising it with the condition of the animal may be a problem. For example, the need for power may arise at either the early or late stage of pregnancy and even a minimum use at these times may lead to abortion or stillbirth.

The highland programme is currently investigating the effect of draught, including

nutritional and environmental stresses, on the physiology of draught oxen and cows. The primary objective of this research is to ensure that feed energy is transformed into work energy as efficiently as possible and to help engineers to develop appropriate implement prototypes (ILCA 1988, p. 40-41). A study on the effect of work and management on fertility and productivity of cross-bred dairy cows will commence in 1991.

The long-run benefit or cost of using cows for draught will depend more on what happens to fertility and productivity of the cow and its effective working life than on the efficiency of feed energy conversion into work energy. Since cow traction is not common in Ethiopia, it will take many years of on-station observation before the effect of draught on the lifetime performance of a cow can be measured. However, evidence available from Asia shows that draught use may seriously affect fertility and productivity of cows, particularly when food is limited, as in the Ethiopian highlands.

Effect of Draught on Cows in Asia

De Boer (1972) found significantly lower herd productivity in Thai villages where females were used for draught compared to those where draught use was absent or less common. Mettrick (1981) found significantly lower calving percentages in villages in Bangladesh where cows were used for draught compared with those where they were not. He used this evidence to explain low national herd productivity. Jabbar and Green (1983) and Jabbar and Ali (1988) have shown on the basis of detailed farm surveys in Bangladesh that draught use adversely affects fertility and milk production. Their results can be summarised thus:

a) Heifers put to draught use were significantly older at first calving than non-draught heifers;

b) calving rate was significantly lower for draught cows, and at any age, a significantly smaller number of calves were born to draught cows;

c) at any age, a cow which was put to draught use before her first pregnancy gave fewer calves than a cow which was put to draught use after one or more calves had been born;

d) services per conception were significantly higher for draught cows and the difference was still higher in older animals and for cows which were used more intensively for draught;

e) Lactation length was significantly lower for draught cows;

f) Peak daily milk yield at a given lactation, an indicator of milk-yielding potential, was significantly lower for draught cows.

Jabbar (1989) has shown that the composition of the national herd changed over time in a way which could be explained by the increased numbers of cows being used for draught, thus causing a decrease in fertility.

Cows were extensively used for draught in Germany during the 1930s and 40s without significantly affecting fertility and milk production because draught cows were given an extra feed allowance (Dr Klaus J. Lampe, personal communication, 1982). John De Boer (personal communication, 1983) suggested that estimates of feed budgets in Asia should include allowances for draught and long distance walks (if appropriate), and the allowance should be higher for draught cows.

In Bangladesh and in other Asian countries, draught use adversely affects fertility and milk production primarily because of poor quality and inadequate quantity of feeds, consisting principally of crop residues. Selective feeding is not very common, and milk cows are favoured for any selective feeding. Draught cows are mostly used by poor farmers whose feed scarcity is also more acute, so the chances of giving any supplement to draught cows is also remote.

Reasons for Cow Traction Development

In a recent detailed study of crop-livestock interaction in sub- Saharan Africa, McIntire et al. (1989) concluded that in the densely populated highland zones where AT is well developed, feed competition between dairy and draught animals constrains animal production, and indirectly crop production. They thought that among animal products, milk probably gave the best returns but its potential level of production would be unlikely to be fully realised without reduced feed competition from draught animals. They recom- mended that research in the highland zones should concentrate on the means of reducing the feed consumption of draught animals, so as to release crop residues for milk production and soil restriction. Such means could include rental markets, cow traction, reducing the number of oxen in the span, mechanisation with engines and new tools. Rental market is currently the principal means of reducing the feed burden of draught animals. They, however, cautioned that one

should not be too optimistic about these avenues because, except for mechanisation, mainly with imported engines, they found cow traction the only major change in draught animal management developed indigenously in Africa or in other parts of the developing world (pp. 8.17 - 8.30). There are two major flaws in this final caution:

Firstly, wherever there is a long history of AT use, with or without cow traction, well developed rental markets are also found, but feed shortage is not the only or the main reason for the development of such markets. Rental markets may indirectly reduce the demand for feeds but they develop because of the indivisibility of the animals and the shortage of capital for smallholders. Animals being indivisible, the number of draught animals maintained on a farm must be a definite small number which may not suit exactly the amount of land owned. For example, of all the farmers owning a pair of bullocks, some may have adequate land to make full use of the pair, some may have more land than can be cultivated by the pair and some may have inadequate land to make full use of them. Under such a situation, a rental market develops because it allows the farmer with a deficit of oxen to cultivate all his land and the surplus owners to earn extra income. Well-developed rental markets already exist in the Ethiopian highlands and such markets will continue to play a major role to balance excess supply and deficit in village communities.

Secondly, they did not explain the circumstances under which cow traction has developed elsewhere and the long-term costs of using cows for draught. Cow traction and single animal ploughs are widely used in South-east Asia but no public body promoted cow traction. Farmers developed it but feed shortage has not been the only or even the main reason for the development of this technology.

In Bangladesh, cow traction is widely used and in Burma, Thailand, Indochina, Indonesia and the Philippines female buffaloes are widely used. Although AT has a very long history in all these countries, cow traction is a comparatively recent phenomenon. A combination of factors including shortages of bullocks, human population pressure, subdivison of holdings, and shortage of capital have contributed to the widespread use of cows for draught. For example, until 1947 when British India was partitioned, only barren cows were used for draught by Muslim farmers in Bengal (part of which is now Bangladesh). Hindus did not use them because of religious customs whereby the cow was given the status of a mother and was exempted from hard work. Now, 50% of the adult cows are used for draught and they constitute about 30% of draught animals in Bangladesh (Jabbar 1989). Initially, a growing imbalance between the supply and the demand for draught bullocks forced Bangladesh farmers to use cows as an alternative. A number of other factors have continued to reinforce this process (Jabbar 1980; Jabbar and Green 1983; Jabbar 1985):

(a) Over the years, mortality due to diseases remained high due to poor veterinary services, and slaughter rates continued to increase with population growth, urbanisation and increased income. Since a significant proportion of the cows of productive age either died or were slaughtered, this kept the growth rate of the livestock population down. Consequently, fewer male draught cattle became available, thus dependence on cows for draught has increased. Use of cows for draught resulted in decreased fertility and as more cows were put to draught use, cattle numbers declined further.

(b) Population pressure and the reduction in the size of land holdings accelerated the process of draught use of cows. Livestock censuses conducted in 1961, 1977 and 1984/85 showed that districts with higher population densities and farms of smaller size had higher proportions of females in the cattle herd and they also used a higher proportion of females for draught purposes. These phenomena can be explained by a number of factors.

  (i) As farms are sub-divided among inheritors, land, cattle and other assets are divided. Through this process, a farmer may end up with one bullock and one milk cow or just one milk cow. Capial constraint may force this farmer to use the cow for draught because otherwise his crop production, the main priority, may suffer.

  (ii) Draught cows are cheaper than bullocks, so farms with capital constraint may choose to buy/maintain draught cows rather than bullocks.

  (iii) Draught cows are considered less powerful than bullocks, so farms with capital constraint may choose to buy/maintain draught cows rather than bullocks. If the power requirement of a farm can be met with cows, the farmer

may choose to keep cows rather than investing a larger amount in bullocks.

(iv) Although not for the same reason as the Hindus, Muslims also used to put a low social status on those using cows for draught. Those who can afford bullocks, such as the large farmers, still resist using cows for draught, but the value system has changed with hardship.

In Bangladesh milk is highly valued but crop production remains the short-term priority. In south-east Asia, milk has little value, because most of the population are lactose-intolerant (Crotty 1980). So loss of milk production due to draught may not be of much importance to them as long as calves get enough for survival.

Thus, in Bangladesh and possibly in other south-east Asian countries, use of cows for draught might have reduced aggregate demand for animal feeds which are, in general, scarce, but overcoming feed scarcity was not the explicit objective of using cows for draught. Therefore, those experiences suggest that cow traction may not be an appropriate option if overcoming feed constraints as well as increasing milk production are the major objectives of developing this technology. Where milk is not valued, the adverse effect on fertility may still make draught use of cows a costly innovation.

Summary and Conclusion

The International Livestock Centre for Africa has been trying to introduce cow traction as an innovation in areas where AT is well developed but feed competition between draught and dairy animals constrains both dairy and crop production. Results of on-farm tests show cow traction more profitable than traditional pair-ox ploughing and single-ox ploughing, another of ILCA's innovations. However, a critical examination of the data and the results show that the claims may not be realistic. Moreover, on- farm tests also indicated that successful introduction of cow traction would require an adequate supply of better quality feeds. Cow traction is extensively used in South East Asia and a review of the diverse circumstances under which cow traction developed there shows that overcoming feed scarcity was not the explicit objective of using cows for draught. Rather, draught use of cows in a feed scarce situation resulted in long-term decline in fertility and milk production.

The implication of the Asian experience is that where food is scarce, promotion of cow traction may not be feasible, as the Debre Zeit farmers have already indicated; but more importantly, it may not be desirable because of the long-term effects on fertility and milk production. If the feed situation can be improved, the single-ox plough may still be a better and more desirable option for promotion than cow traction. If population pressure, capital constraint, sub-division of holding or other reasons force/induce the farmers to use their cows for draught, steps should be taken to minimise the effect of draught on fertility and milk production. Research on cow traction may be directed to that end if there is a possibility of such a situation occurring in the near future.

Résumé

Cette communication confronte les conclusions tirées des travaux du CIPEA sur l'utilisation des vaches de trait et des attelages à un boeuf en Afrique, avec celles tirées d'études effectuées en Asie du Sud-Est et basées sur l'expérience des paysans de cette région, en particulier ceux de Thaïlande et du Bangladesh.

Les travaux du CIPEA tendent à démontrer que l'utilisation de la vache en culture attelée est plus rentable que la traction à un seul boeuf, et que ces deux types d'attelages sont eux-mêmes supérieurs aux attelages à deux boeufs. La présente communication jette un certain doute sur ces conclusions et note que la nécessité de disposer de grandes quantités d'aliments de qualité pour nourrir les vaches de trait risque de poser des problèmes. L'expérience acquise en Asie montre elle aussi que l'utilisation de femelles mal nourries en culture attelée finit par entraîner une baisse de la fertilité et de la production de lait. Par conséquent, si les seuls aliments disponibles sont de qualité médiocre à moyenne, la traction à un seul boeuf peut constituer la meilleure option dans les conditions de l'Afrique, même si elle implique l'entretien d'un plus grand nombre de bovins.

References

Agyemang, K., Abiye Astatke, Anderson, F.M. and Mariam, W. Undated.

Early indications of effects of work on reproductive and productive performance of crossbred dairy cows in the Ethiopian highlands. Unpublished Mimeo. Inter- national Livestock Centre for Africa, Addis Ababa, Ethiopia.

Abiye Astatke, Reed, J.D. and Butterworth, H.M. 1986. Effectof diet restriction on work performance and weight loss of local Zebu and Friesian x Boran cross bred oxen. ILCA Bulletin, 23 (January), 11–14. ILCA, Addis Ababa, Ethiopia.

Crotty, R. 1980. Cattle, economics and development. Commonwealth Agricultural Bureaux, Slough, U.K.

De Boer, J. 1972. Technical and economic constraints on bovine production in three villages in Thailand. Ph.D thesis, University of Minnesota, Mineapolis, St. Paul.

Gryseels,G.,Abiye Astatke, Anderson, F.M. and Assemenew, G. 1984. The use of single oxen for crop cultivation in Ethiopia. ILCA Bulletin 18 (April), 20–25. ILCA, Addis Ababa, Ethiopia.

ILCA (International Livestock Centre for Africa). 1986.ILCA Annual Report (1985/86). Addis Ababa, Ethiopia.

ILCA. 1987. ILCA Annual Report (1986/87). Addis Ababa, Ethiopia.

ILCA. 1988. ILCA Annual Report (1987). Addis Ababa, Ethiopia.

ILCA. 1989. ILCA Annual Report (1988). Addis Ababa, Ethiopia.

Jabbar,M. A. 1980. Draft power shortage and mechanisation of tillage in Bangladesh. Bangladesh Journal of Agricultural Economics, 3,1 (June).

Jabbar,M.A. 1985. Animal power situation in Bangladesh. Report prepared for Asian Regional Team on Employment Promotion. International Labour Organisation, Bangkok, Thailand.

Jabbar, M.A.1989. An assessment of the quality of livestock statistics of Bangladesh. Bangladesh Journal of Agricultural Economics,12,1 (June).

Jabbar,M.A. and Ali, S.Z. 1988. The limitations of cross breeding for improvement of cattle in Bangladesh. Oxford Agrarian Studies, 17, 29–56.

Jabbar, M.A. and Green, D.A.G. 1983. The status and potential of livestock within the context of agricultural development policy inBangladesh. Research Report, Department of Agricultural Economics, University College of Wales, Aberystwyth, U.K.

McIntire, J., Bourzat, D. and Pingali, P. 1989. Crop livestock interactions inSub-Saharan Africa. InternationalLivestock Centre for Africa, Addis Ababa, Ethiopia.

Mettrick, H. 1981. Some aspects of the economics of animal power. In Mettrick, H.M. and James, D.P (ed.). Farm Power in Bangladesh. Development Study No.20., Department of Agricultural Economics and Management, University of Reading, Reading, U.K.