

Towards a More Realistic History of Plough Cultivation in Early India

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Agriculture has been the main occupation in India several millennia.¹ In agriculture, plough cultivation has always played the most significant role.² The aim of this study is to revisit some commonly accepted theses on ploughing technique and the plough in scholarly literature, to analyse the different plough types as they appear in Sanskrit texts and archaeological evidence and take an unbiased standpoint on the question whether there were substantial changes in this technique or not. My investigations broadly cover the long period which is generally called early India.³

It goes without saying that almost all leading historians of the independent India touched upon the role of the plough in Indian economic history. As they conceived it, this surplus is due to the widespread use of a sophisticated type of the plough and a series of innovations in agricultural practices.

The pioneer of this line of research is D. D. Kosambi, a man of genius⁴ and a dedicated Marxist, and to whom "his familiarity with the Maharashtrian countryside gave an insight into the readings of early texts."⁵ As he puts it, "early cities after the ruin of Harappā and Mohenjo-dāro implied heavier stress upon

¹ Gy. Wojtilla, „Kṛṣiparāśara“ in *Wissenschaftliche Zeitschrift der Humboldt-Universität zu Berlin*, 3 (1976), 377.

² Cf. Gyula Wojtilla, „The Plough as Described in the Kṛṣiparāśara,“ in *Altorientalische Forschungen* 5 (1977), 246.; Laping, Johannes, *Die landwirtschaftliche Produktion in Indien. Ackerbau-Technologie und traditionale Agrargesellschaft dargestellt nach dem Arthaśāstra und Dharmaśāstra*, Beiträge zur Südasiens-Forschung, Südasiens-Institut Universität Heidelberg 62, Wiesbaden 1982, v.

³ Cf. Romila Thapar, *The Penguin history of early India from the origins to AD 1300*. London 2003, 30-32.

⁴ Beside being a professor of mathematics at the most famous Indian and American universities, he published excellent books on Indian history, on prehistoric art and prepared critical editions from Sanskrit poetry.

⁵ Thapar, *The Penguin history*, 22.

agriculture than in pastoral economy. Already the Yajurveda speaks of ploughs drawn by twelve-ox teams; such ploughs are in use to this day, indispensable for driving deep furrows and turning over heavy soil which otherwise will not yield well or retain its fertility. The strong plough could be made of wood trimmed down by bronze tools, but the ploughshare in east Punjab, particularly on stony soil near watershed, had to be of iron."⁶

This statement is all right as far as it goes. Nevertheless, I think that we have to regard it as a snapshot of the real value of which can only be estimated if we turn back to its antecedents.

As a matter of fact, plough cultivation is markedly present in the age of the Ṛgveda and the Atharvaveda. Although the agricultural vocabulary of the Ṛgveda is meagre, it contains two names of the plough: *lāṅgala* (4, 57, 4) and *sīra* (4, 57, 8; 10, 101, 3 and 4) and the name of the ploughshare: *phāla* (4, 57, 8; 10,117,7). Together with other words referring to agricultural tools and operations they are sufficient to postulate an established position of agriculture mostly based on grain producing. Nevertheless, agriculture was still of less importance than pastoral economy.⁷ A cursory glance at the contents of the Atharvaveda corpus is sufficient to see the increasing importance of agriculture in everyday life.⁸ As Romila Thapar aptly says, "the plough became an icon of power and fertility." Its name is *lāṅgala* (2, 8, 4) and *sīra* (6, 30, 1; 6, 91, 1; 8, 9, 16) as in the Ṛgveda, however, the number of its constituent parts is higher, i.e. it is a more sophisticated type than that of the latter. The Atharvaveda lists beside the ploughshare (*phāla* 10, 6, 6 etc., moreover *suphāla* "a good ploughshare") a handle (*tsaru* 3, 17, 3)⁹, a pole (*iṣā* 2,8,4) yoke (*yuga* 2,8, 4) and a lance-shaped (*pavīravat* 3, 17, 3) ploughshare (*phāla*).¹⁰ The interpretation of the term *pavīravat* is still a highly intricate matter. Some scholars think of a metal share,¹¹ however, it has seriously been challenged by Rau. He is rather inclined to the meaning "lance-shaped" proposed by Whitney, i.e., the term refers to the shape of this part of the plough and not to its material.¹² This idea has also been

⁶ D. D. Kosambi, *The culture & civilisation of ancient India in historical outline*. New Delhi 1970, 88-89. First published: London, 1965.

⁷ Gyula Wojtilla, "What can the Ṛgveda tell us on agriculture?" *Acta Orientalia Academiae Scientiarum Hungaricae* 56:1 (2003), 44-45.

⁸ Gyula Wojtilla, "Agricultural knowledge as it is reflected in the Śaunakīya Atharvaveda," in *Samskṛtavimarśaḥ* 6. World Sanskrit Conference Special, New Delhi 2012, 41.

⁹ It is a problematic word. On the basis of the commentaries, Whitney renders it as "handle." Cf. *Atharva-Veda-Saṃhitā* translated into English by W. D. Whitney. Delhi-Varanasi-Patna 1971, vol. I, 115-16.

¹⁰ *Atharva-Veda*, I, 115-16.

¹¹ H. Zimmer, *Altindische Leben*. Berlin 1879, 236; A. A. Macdonell and A. B. Keith, *Vedic index of names and subjects*. London 1912 Vol. I, 509; K. Mylius, "Die gesellschaftliche Entwicklung in jungvedischer Zeit nach den Sanskritquellen I. Der Entwicklungsstand der Produktivkräfte," in *Ethnographische-Archäologische Zeitung* 12 (1971), 174.

¹² W. Rau, *Staat und Gesellschaft im alten Indien*. Wiesbaden 1957, 25.

accepted by Ruben.¹³ Such a plough could effectively work in the light soil of the upper Ganges plain.¹⁴

The next puzzling question is the use of iron to make ploughshares in the Vedic period. It is a hard fact that the earliest known specimen of iron ploughshare comes from Ganwaria in District Gorakhpur, Uttar Pradesh and dates from ca. 700 BC.¹⁵ In the other hand, Witzel dates the Śaunakiya Atharvaveda on the basis of the phrase *śyāma ayas* (11, 3, 7) – he takes it as iron – from c. 1200 BC. According to him, the place of genesis of the text in the land of the Pañcālas (eastern Uttar Pradesh, up to Kauśāmbī/ Allahābād/ Kāśī).¹⁶ But his assumption is not compelling. As opposed to this, recent work on the archaeological evidence of iron industry in India reveals that there are levels yielding iron objects at Kauśāmbī datable from 1100–1000 BC.¹⁷

It is generally held that the text of the Atharvaveda may be contemporary of the latest parts of the Ṛgveda, traditionally dated from c. 1200–1000.¹⁸ Moreover *śyāma ayas* rather means “*graues Nutzmetall*” (approx. “grey industrial metal”).¹⁹ It means that the text can tentatively be dated from ca. 1000 BC, which timely coincides with the appearance of iron. Here we must also keep in mind Erdosy’s opinion that the full use of iron for quite different purposes appears in the Ganges Plain only after the 6th century BC.²⁰ So it is reasonable to assume that the use of iron in the earliest period might have been restricted to weapons or smaller household implements.²¹ In the light of the above con-

¹³ W. Ruben, *Die gesellschaftliche Entwicklung im alten Indien I. Die Entwicklung der Produktionsverhältnisse*. Berlin 1967, 67 and 92, n.96.

¹⁴ R. S. Sharma, *Ancient India*. New Delhi 1980, 54.

¹⁵ Vibha Tripathi, “The early Indian agrarian society and technology adaptation,” in *History of agriculture in India up to c. 1200 AD* edited by L. Gopal and V. C. Srivastava, History of science, philosophy and culture in Indian civilization vol. V, New Delhi 2008, 372.

¹⁶ M. Witzel, “Early Sanskritization. Origins and development of the Kuru state,” in *Electronic Journal of Vedic Studies* 1-4 (1995), 4.

¹⁷ Vibha Tripathi, *History of iron technology in India (from beginning to pre-modern times)*. New Delhi 2008, 42.

¹⁸ K. Mylius, *Geschichte der altindischen Literatur*. 2., überarbeitete und ergänzte Auflage. Wiesbaden 2003, 17-18.

¹⁹ W. Rau, *Metalle und Metallgeräte im vedischen Indien*. Akademie der Wissenschaften und der Literatur Mainz. Abhandlungen der Geistes- und sozialwissenschaftlichen Klasse, Jahrgang 1973, Nr 8, Mainz 1974, 21.

²⁰ G. Erdosy, “The prelude to urbanization: ethnicity and the rise of Late Vedic chiefdoms,” in *The archaeology of early historic South Asia. The emergence of cities and states* ed. by F and F. R. Allchin. Cambridge 1995, 84.

²¹ Cf. R. S. Sharma, “Die Entwicklung der Produktivkräfte und ihre sozialen Folgen in Indien im 1. Jahrtausend v.u. Z. (unter besonderer Berücksichtigung von Bud-dhas Zeit,” in *Produktivkräfte und Gesellschaftsformationen in vorkapitalistischer Zeit* herausgegeben von J. Herrmann und Irmgard Sellnow. Berlin 1982, 210.

sideration it would be safer to think that the plough and its ploughshare described in the Śaunakiya Atharvaveda were made of wood.²²

Against the existence of iron ploughshare in the time of the Yajurveda speak other texts which are somehow later. The Śatapathabrāhmaṇa 7, 2, 2, 3 definitely says that is made of *udumbara* (*Ficus racemosa* Wall) wood and the Jaiminiyabrāhmaṇa (2, 84) mentions a primitive type of plough, i.e. *vakraṃ dāru* "a curved piece of wood," simply a branch of a tree.²³

As to the use of bronze for agricultural tools there are few findings are reported from Israel, Egypt, Babylon and the Roman Empire. Therefore some scholars reckon with widespread use of bronze for this purpose before the introduction of iron. A plough with a bronze ploughshare is reported from Burma from the beginning of the twentieth century. In this question we follow Iván Balassa, the outstanding expert at plough research, who does not share the above opinion and considers the account of the Burmese plough inadequately checked.²⁴ In short, the widespread use of bronze ploughshares in India in the age of the Yajurveda can be ruled out.

M. S. Randhawa, an outstanding scientist, who was closely associated with the modern India's agricultural research, is the author of the hitherto best comprehensive history of Indian agriculture. In this book, he takes it for granted that "iron ploughshares and sickles of iron made farming more efficient in the Buddhist period."²⁵ Among the acknowledgements for various helps during the writing his book he expressly thanks Sharma whom he calls, "the first scholar in India to provide an interpretation of the history of the country in the context of its material culture."²⁶

The next scholar I have to mention is R. S. Sharma. As a man of profound knowledge of rural life and of extraordinary erudition and an admirer of Kosambi he has written epoch-making studies concerning agricultural production and agricultural society. In his numerous writings on a high plane, he was able to combine the text-based exploration of things with an up-to-date knowledge of the archaeological evidence and to interpret them in a progressive way. What I call progressive in his thinking that came from the Marxism represented by leading intellectuals in the 1950s in London and his love for the Indian peasants. It is not by accident that he prepared his ground-breaking Ph.D. thesis, called *Śūdras in ancient India* under the supervision of the legendary A. L. Basham.²⁷ Like Kosambi, he had an eye on the survivals of the ancient ma-

²² Wojtilla, "Agricultural," 47.

²³ Cf. Rau, *Staat*, 25; Gy. Wojtilla, "The Sanskrit terminology of the plough," in *Acta Orientalia Academiae Scientiarum Hungaricae* 42: 2-3 (1988), 327 and n. 10.

²⁴ Iván Balassa, *Az eke és a szántás története Magyarországon*. [The history of the plough and the ploughing in Hungary.] Budapest 1973, 72.

²⁵ M. S. Randhawa, *A history of agriculture in India*. Volume I. *Beginning to 12th century*. New Delhi 1980, 338.

²⁶ Randhawa, *A history*, XI.

²⁷ R. S. Sharma, *Śūdras in ancient India*. *A social history of the lower order down to circa A.D. 600*. Delhi 1958. Several reprints.

terial culture in modern India and was a constant source of inspiration for generations of Indian scholars and also for me.

He has gained distinction with mapping the traces of early plough culture in northern India in the first millennium BC.²⁸ All this served as an introduction to his theory on iron-based agriculture which he regarded as a base of urbanisation in the Ganges plain. He assigns the age of the Buddha, which he dates from around 500 BC, for the time of full-fledged iron-based agriculture.²⁹ Being a son of the Patna area in Bihar, he convincingly argues that the typical soil in that area requires the use of iron ploughs. Not sweeping the lack of such objects from eastern Uttar Pradesh and Bihar under the carpet, he tries to explain it with the devastating effect of the acid, humid and warm soil.³⁰ He does not forget to say that iron tools occur in a considerable number at sites where the soil conditions are more favourable, for instance in Madhya Pradesh and Punjab. In this connection he referred to so far unpublished information on the finding of an iron ploughshare from Ropar, District Ambala.³¹ Beside the innovations in ploughing technique he thinks that the transplantation of paddy seedlings, an innovation in the same period, was the main source of sudden increase in agricultural production.³² These assumptions have been met with both approval and refusal.

The chief opponent of Sharma's views is R. Gombrich, a leading western authority on the social history of early Buddhism, who has challenged both his basic theses. He thinks that, even acknowledging the devastating power of natural conditions, the presence of good quality iron is questionable. Moreover, urbanization "can occur without any iron."³³ The appearance of transplantation he holds to be a guess. He is convinced that similar techniques "may have been used much earlier than the Buddha."³⁴ In order to form a balanced view of their discussion one has to keep in mind that the underlying ideology in Gombrich's attitude ultimately comes from that of Karl Popper who totally rejects the Marxist theory which holds that history progresses.³⁵

Romila Thapar, unquestionably the greatest living Indian historian of our days and also a pupil of Basham in London, who is accused with leftism and Marxism by Hindu nationalists, formed a more nuanced view of the same issues. Not denying the high importance of the use of iron ploughs confirmed also by Buddhist texts, she explains the rare occurrence of iron shares with the soil types other than that in the Ganges Plain, i.e., on vast territories wooden shares suffice. She seems to put more emphasis on slash and burn technique

²⁸ Sharma, "Die Entwicklung," 209-212.

²⁹ Sharma, "Die Entwicklung," 212.

³⁰ Sharma, "Die Entwicklung," 215-216.

³¹ Sharma, "Die Entwicklung," 216.

³² Sharma, "Die Entwicklung," 218.

³³ R. Gombrich, *Theravāda Buddhism. A social history from ancient Benares to modern Colombo*. London and New York 1994, 51.

³⁴ Gombrich, *Theravāda Buddhism*, 52.

³⁵ Cf. Gombrich, *Theravāda Buddhism*, 12.

in clearing forest for agriculture that the use of iron axes and “the qualitative improvement in the making of items from bone, glass, ivory, beads of semi-precious stones and shell, and stone objects as compared to earlier Chalcolithic levels.” She means that “agricultural expansion and the use of iron are in themselves necessary but not sufficient factors in the creation of a surplus to bring about urbanization and state systems.”³⁶

The same issue was also touched upon by Irfan Habib, a dedicated Marxist, the greatest authority on economic history of Muslim India³⁷ in his presidential address delivered on the plenary session of the Indian History Congress at Kurukshetra in 1982. In his rather ambitious lecture entitled *The peasant in Indian history* he expressly connects the genesis of the “universalization of peasant farming” and the birth of “a caste-divided peasantry with the iron tools” and “the growing multiplicity of crops.” In his analysis he heavily draws on Kosambi, Sharma and the famous Marxist archaeologist, Gordon Childe. As to the effect of the wider use of iron he invokes Gordon Childe’s “perceptive observation” that “cheap iron democratized agriculture” through which peasants could “afford an iron axe to clear fresh land for himself and iron ploughshares wherewith to break stony grounds.”³⁸ As now is held Childe’s opinion represents an oversimplification of matters. In spite of all this Habib’s paper has been reprinted more than once since its first publication.³⁹

As to the alleged progress in agricultural technique beside the time of the Buddha the period called early medieval time arrested especially the attention of the above mentioned scholars and their followers in Europe. This latter issue is closely with the problem of the question of Indian feudalism.⁴⁰

Marlene Njammasch is of the opinion that the evolution of tools, the rotation of crops, the use of manure, the use of ploughs furnished with heavy iron share, the growth in the cultivation of cotton, sugarcane, oil-seeds, and spices as well as the progress in irrigation technique by using wells are the main symptoms of progress in agricultural production.⁴¹ But the greatest part of the ruling class became altogether separated from the soil (*Boden*) and had no more interest in the improvement of agricultural technique. They were satisfied with

³⁶ Thapar, *The Penguin history*, 144.

³⁷ For instance, he is the author of *The agrarian system of Mughal India 1556-1707* first published in Bombay 1963 or the co-editor of *The Cambridge economic history of India vol. I. c. 1200-1750*. Cambridge 1982.

³⁸ I. Habib, “The peasant in Indian history,” *Social Scientist* 11:3 (March 1983), 30-31.

³⁹ Cf. I. Habib, *Essays in Indian History: Towards a Marxist perception with the economic history of medieval India*. Anthem Press, London 2002, 109-160. Indian edition: New Delhi 2005.

⁴⁰ The hitherto classical work upon this subject is R. S. Sharma: *Indian feudalism: c. 300-1200*. Calcutta 1966 and its several enlarged and revised editions.

⁴¹ Marlene Njammasch, “Die Entwicklung feudaler Verhältnisse in Indien (3.-12. Jh.),” in *Allgemeine Geschichte des Mittelalters*, Berlin 1985, 169.

extorting the surplus from the farmers and this proved to be a great obstacle to the further economic development and to the development of the cities.⁴²

Sharma summarizes the changes thus: a kind of big plough (*brhadhala*) is recorded in a tenth-century inscription from the Ajmer area; a pounder has been found in the territory of the late Pāla kingdom; progress in irrigational technique, rice transplantation; use of fertilizers; observance of weather conditions; precise knowledge of cereals.⁴³

Unlike to Kosambi, Sharma, Habib or even Romila Thapar⁴⁴ and Marlene Njammasch, Lallanji Gopal remained fully untouched by the Marxist interpretation of history. Also being a pupil of Basham he has taken an open-minded approach to economical history, but he remained an adherent of classical English economics. Instead of constant seeking for progress and its consequences in economy and society he presented a real snapshot of the agricultural technique in early medieval India. The focal points of his study were irrigation and rains⁴⁵; soil, manure, seed and, sowing;⁴⁶ agricultural implements, especially the plough;⁴⁷ ploughing and draught animals employed in it;⁴⁸ harrowing, weeding, protection of crops, harvesting, and storing of grain.⁴⁹ His study abounds in fine remarks on details and excels in a prompt analysis of the plough as it is depicted in the *Kṛṣiparāśara*. His exemplary approach to the source material and the personal advices I received from him at the Banaras Hindu University in the academic year 1973-1974 substantially helped me to enlarge the scope of my interest in the history of agriculture in India.

During my years in Delhi in the early 1980s I had the chance to enjoy the friendship of R. S. Sharma. He encouraged me to combine, as he used to say, my "bookish" knowledge with the archaeological evidence and the cultural survivals to be seen everywhere in India. Having a strong faith in economical and social progress and highly appreciating his and Kosambi's scholarship, I devoted a paper to a reassessment of the main points made by Njammasch and Sharma on agricultural development in the early medieval times.⁵⁰ In my work I had to rely almost exclusively upon the textual data this purpose because the

⁴² Marlene Njammasch, *Untersuchung zur Genesis des Feudalismus in Indien*. Schriften zur Geschichte und Kultur des alten Orients 17, Berlin 1984, 151.

⁴³ R. S. Sharma, *Urban decay in India* (c.300-c. 1000). New Delhi 1987, 173-174.

⁴⁴ Romila Thapar says, "A paradigm shift in the understanding of historical change in India was introduced by Marxist interpretations that began as historical debates from the 1950s onwards. The historical writings of D.D. Kosambi, in particular, encapsulated this shift." Cf. Thapar, *The Penguin history*, 22.

⁴⁵ Lallanji Gopal, "Technique of agriculture in early medieval India (C. 700-1200 A.D.)," in *University of Allahabad Studies 1963-64 Ancient History Section*, 1-18.

⁴⁶ Gopal, "Technique," 18-27.

⁴⁷ Gopal, "Technique," 27-29.

⁴⁸ Gopal, "Technique," 29-33.

⁴⁹ Gopal, "Technique," 33-37.

⁵⁰ Gyula Wojtilla, "Rural expansion in early medieval India. A linguistic assessment," *Altorientalische Forschungen* 18 (1991), 163.

archaeological evidence exclusively by plastic arts yielded is very meagre. The results of my study corroborated their theses with regard to the fertilising, irrigation, the transplantation of paddy seedlings, the increase of number of plants produced and the more precise knowledge of cereals, especially of the rice. Although the rotation of crops is recorded in an eleventh century text, because their want in the *Kṛṣiparāśara* nor the *Kāśyapīyakṛṣisūkti*, the two most important agricultural treatise of the age, it cannot be taken as a general practice.

The great variety of sources allowed me to find different kinds of the plough. While the *Amarakośa*, the most famous traditional Sanskrit lexicon, describes a plough consisting of four parts, the *Kāśyapīyakṛṣisūkti* speaks of the parts only collectively and mentions separately only the ropes used to harness the plough and the pole, which is made of hard wood. The descriptions in the sacred books of the *Vaikhānasas* record five parts of the plough used in ritual ploughing. The *Kṛṣiparāśara* informs us a plough fit together from eight parts. The *Bṛhatparāśarasmr̥ti*, a juridical compendium dated to the period between 1100-1400 AD, speaks of a plough having nine parts including the iron ploughshare (*lohaphāla*) and says that the depth of the furrows can be regulated by means of ropes. The *Mānasāra*, a text on architecture from the centuries before 1100 shows a plough put together from five parts where the iron ploughshare is fitted into the sole by an iron peg. There is a beautiful relief from Kavi (South Gujarat) where the body and the sole of the plough make an obtuse angle, it has a tail-formed stilt and a long beam, the beam seems to be fitted into the body with a brace-rider. The increase of the popularity of the agricultural deity Balarāma whose main attribute is the plough and his appearance in numerous reliefs is also a remarkable symptom.⁵¹

My conclusion was that agricultural production stood in strong feet in early medieval India and the sources allow us to recognise some traits of technical development. However, the general standard of life was uneven in the period.⁵² I have uncritically taken over Sharma's and Njammasch' conception of the high importance of the big plough (*bṛhadhala*). Now I see that this term has yet to be assessed to the degree it clearly deserves. I think that it is a synonym of the name *mahadhala* "a big plough" which has been mentioned in Tale 23 of the fifteenth century *Bharatakadvātr̥ṃśikā*. The text says that a husbandman, having put the big plough (*mahadhala*) on his head, went to the field. Later overcome by the excessive burden (*atibhārākrānta*) he removed the big plough (from his head) and threw it to the ground. This description is rather controversial. An on the head portable plough cannot be too heavy or of too big size. On the other hand, the word *atibhāra* "excessive burden" seems to contradict to this supposition. From a brief survey a considerable number of wooden ploughs from the second part of the twentieth century it appears that their

⁵¹ Wojtilla, "Rural," 166-167.

⁵² Wojtilla, "Rural," 168.

weight ranges between 9-12 kg.⁵³ A normal plough is easily portable on the shoulder by an average cultivator.⁵⁴

There are other references to the alleged presence of "the big plough" in early India. Agrawala seems to know that *hali* and its synonym *jitya* mean "a large plough" in the Aṣṭādhyāyī of Pāṇini (3, 1, 117) and they were used "to break the hardest ground and to reclaim waste land."⁵⁵ But Apte takes it as "an instrument for levelling or smoothing ploughed ground (Marāṭhī *kuṭṭav*)," while *hali* as "a large plough"⁵⁶. At the same time the word in the compound Śatahali lit. "one who has one hundred ploughs" which is the name of a great landlord (Daśakumāracarita p. 120)⁵⁷ simply means "a plough." A problem that remains is that these data are insufficient for imagining such a tool and the way it works. These words are merely names without specified contents.

Having revisited Sharma's arguing with the term *brhadhala*, I recognised that he had uncritically quoted the relevant passage from B. P. Mazumdar's paper. Majumdar states that "the big plough, already known in the time of Pāṇini (*Hali* and *Jitya* 3. 1. 117), seem to be identical with *brhadhāla* [sic!], mentioned in the Harṣa stone inscription of Cahamāna Vigharāja, dated VS 1080/A.D. 937."⁵⁸ But a perusal shows that Mazumdar's interpretation of *brhadhala* in this inscription is wrong. From the context it is quite clear that the term stands in connection with land donation and the term refers to the size of the land donated to somebody. *Brhadhala* simply means here "a big plough of land"⁵⁹ and not a big plough. It should be dropped together with the preconceived theory of progress in ploughing technique previously maintained by Sharma, Njammash, myself and many others.

An outline of the history of ploughing technique and the plough

Ploughing cultivation has two essential prerequisites: the plough and the draught animals to move it. They were probably not absent from the Harappan culture. The excavations at Kalibangan, a site 350 km west of Delhi, yielded ard

⁵³ Cf. *Indigenous agricultural tools and equipment of Bangladesh*. Agricultural Engineering Division, Bangladesh Agricultural Research Council, Dacca 1982.

⁵⁴ Kosambi, *The culture*, Fig. 33.

⁵⁵ V. S. Agrawala, *India as known to Pāṇini*. [A study of the cultural material in the Aṣṭādhyāyī]. Second edition revised and enlarged, Varanasi 1963, 198. Cf. M. Monier-Williams, *A Sanskrit-English dictionary*. Oxford, 1960, 420 and 1293.

⁵⁶ V. S. Apte, *The practical Sanskrit-English dictionary*. Revised and enlarged. Ed. by P. K. Gode and C. G. Karve, Poona 1979, 738 and 1751.

⁵⁷ *The Daśakumāracarita of Daṇḍin*. With various readings, a literal English translation etc. by M. R. Kāle. Delhi-Varanasi-Patna, 1966⁴.

⁵⁸ B. P. Mazumdar, "Industries and international trade in early medieval North India," *Journal of Bihar Research Society* 45-46 (1979-1980), 231. For procuring a copy of this journal in London my special thanks are due to my colleague and friend, Gergely Hidas.

⁵⁹ Cf. *Epigraphia Indica* vol. II (1894), 125. and F. Kielhorn's translation, *ibid.*, 130.

furrows which can be dated from 2900–2700 BC. The narrow furrows were sown with horse-grains, and the mode widely space ones grew mustard plants.⁶⁰ But where is the plough by which the work has been carried out? As a matter of fact not any plough or its parts have come down to us from this period. Randhawa rightly thinks that because ploughs were made of wood, a perishable material there is no possibility of finding an actual wooden plough from this age.⁶¹ All that we have is a terracotta model of an ard-plough from Mohenjo-daro, c. 2300 BC and a seeder-ard-like object on a seal from Lothal.⁶² A clay model from Banwali, a site 120 km northeast from Kalibangan, allows us to form a clearer idea of the plough in the Indus culture. It is a combined form of the beam and the sole. The beam is curved like an inverted “S” with a hole at the front end. The tip of the sole is sharply pointed. Its extended rear is pierced by a vertical hole to receive a curved or vertical stilt. An implement like this might have been used to loosen the soil rather than to make deep furrows.⁶³

From around the last centuries of the second millennium BC there is textual evidence for the existence of various types of the plough. The term *sira* in the R̥gveda may refer to a seeder-ard which the ancestors of the Vedic Sanskrit speakers might have adopted somewhere on their way to India. Later the same word might have been used for the same type of instruments already known in India. An antler piece made into an artefact has been excavated — a seed-drill — from the site of Walki.⁶⁴ The term *lāṅgala* is a loanword in Sanskrit from some Austro-Asiatic language and together with the closely related form *lāṅgula* has a broad semantic field including the meaning “penis”, “an ard-plough” and “tail”. It is not quite impossible that the word originally denoted a digging stick or even a simple curved branch of a tree (see *vakraṃ dāru*).

Sanskrit sources from the first centuries of the first millennium BC speak of ard-ploughs fitted together from different accessory parts. In spite of the found of remains of an iron ploughshare from Ganwaria (ca. 700 BC) and a similar found from District Etah, western Uttar Pradesh from around 500 BC and the numerous allusions to iron ploughshare in the Buddhist literature the employment of iron for manufacturing iron ploughshares is rare and exceptional.⁶⁵ The absolute majority of ploughs was made of wood in the first millennium. I do not deny that the plough consisting of more accessory parts represents a more sophisticated type than for example the *vakraṃ dāru*. Notwithstanding, now I regard the assumption of a revolutionary development of

⁶⁰ A. Steensberg, *Hard grains, irrigation, numerals and script in the rise of civilisations*. Copenhagen 1989, 68-73.

⁶¹ Randhawa, *A history*, 156.

⁶² Randhawa, *A history*, 156 and Fig 78 and 157 and Fig. 79.

⁶³ Gy. Wojtilla, *The ard-plough* 95 and 96 and Fig.3; cf. *Indian Archaeology* 1983-4, 26 and Fig. 21.

⁶⁴ V. Shinde, *Two unique*, 210 and 213-215.

⁶⁵ Sharma, *Die Entwicklung*, 216-217.

ploughing technique in the time of the Buddha maintained formerly by Kosambi, Sharma and me⁶⁶ far-fetched.

The illustrations of ploughing on reliefs from the period second century BC – second century AD are of some help to imagine the different types of this tool.⁶⁷ But neither the exact construction nor the material of the ploughshare can be inferred from them.

Apart from the single found of an iron ploughshare of a paring plough (?) from the second century AD kept at the Sanchi Museum⁶⁸ we do not have plough findings up to the end of the period under discussion.

The increase of the number of varieties of the plough after 500 AD is striking, but it is evident from the descriptions that one must count with types of quite different standard. This situation may be due to the various geographical and physical conditions of the agricultural areas. It cannot go unmentioned that the authors of these description in Sanskrit texts were brahmins who – as Kosambi puts it – “acted as pioneers in undeveloped localities; they first brought plough agriculture to replace slash-and-burn cultivation or food-gathering.”⁶⁹ Their role becomes visible in the coining of Sanskritised terms of agriculture, supplying theoretical knowledge of astronomy, botany, economy and law and codifying popular wisdom deposited, for example, in the collections of sayings in vernaculars.⁷⁰

There is no proof of the employment of special big or heavy ploughs. Wooden ploughs remain prevalent, although some parts of them are from time to time made of iron. The greater number of constituent parts, in the description of the Kṛṣiparāśara, does not necessarily mean that it goes on a more sophisticated type of the plough. Just in this case I have grave doubt of the expertise of the compiler, a learned Brahmin, who rendered various maxims in vernacular tongues into Sanskrit without editing them. The Mānasāra shows an ard-plough may have been made of one piece of wood. Signs of sophistication appear in the descriptions of Bṛhatparāśarasmṛti and the Śukasaptati, a piece of Sanskrit narrative literature, dated to the time before the thirteenth century AD. In the former there is a practical instruction on how to make deeper furrows, in the later there is an additional accessory part, the prop, which serves for fixing the ard-share. The position of this prop can be regulated with the help of a strong rope made of leather straps.⁷¹

For the time being this is all I can say about plough cultivation and the plough in early India. This record bears rather the testimony of long continuity than of big jumps in the history of the plough. The employment of the iron in plough technique was and remained optional and depended on the physical

⁶⁶ Cf. Wojtilla, *The ard-plough*, 98.

⁶⁷ Cf. Wojtilla, *The ard-plough*, 98

⁶⁸ Randhawa, *A history*, Fig. 189.

⁶⁹ Kosambi, *The culture*, 172.

⁷⁰ Gy. Wojtilla, *History of Kṛṣiśāstra. A history of Indian literature on traditional agriculture*. Wiesbaden 2006, 15.

⁷¹ Wojtilla, *The ard-plough*, 104-105.

quality of the arable land. In this connection let me turn back once again to Kosambi who had a unique sense for cultural survivals. In his above cited book he puts two photos on one page. The above one shows a modern plough derived from the Kushāna type, in use near the Ganeṣa Lenā Buddhist caves at Junnar, Maharashtra state, the below one figures a Kushāna plough kept at the Lahore Museum (Pakistan) from ca. 200 AD.⁷²

All this is very edifying. Instead of hunting for big qualitative changes in the long history of the ploughing technique and the plough and attributing fundamentally economical and social changes to them, I would rather speak of quantitative changes in plough cultivation. The first really great achievement was the bringing under cultivation of more and more land in the Ganges Plain and adjoined areas around the middle of the first millennium BC. A real social change in the early medieval times was what Romila Thapar calls, “the expansion of agriculture through the transformation of non-sedentary peoples into peasants, a change that occurred largely in peripheral areas” after 800 AD.⁷³

⁷² Kosambi, *The culture*, Figs. 14 and 15.

⁷³ Thapar, *The Penguin history*, 445.