

AGRICULTURE IN THE VEDIC PERIOD

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The period of composition of the entire Vedic literature, from the *Samhitas* to the *Sūtras*, was presumably between c 1500 BC to c 5th century BC. Information on agricultural practices in the Vedic literature is mostly sporadic, not in the form of a narrative account.

Agriculture embraces two-fold activities: raising of crops involving a number of practices, and domestication of animals. This paper intends to highlight the following aspects of agricultural practices in this period: (i) soil, land and village settlement, (ii) manure and manuring, (iii) crop husbandry inclusive of plant protection measures, agricultural technology and agricultural implements, (iv) irrigation system, (v) animal husbandry, and (vi) meteorological observations in relation to crop prospects.

Key words: Agricultural implements, Chalcolithic, Hymns, *Jāṅgala*, *Kṣetrapati*, *Kṛṣi*, *Samhitās*, *Sūtras*, Tillage, Vedic literature.

INTRODUCTION

Cultivation presupposes a long process to attain a change from the stage of food collection to the state of sowing of crops under favourable climate conditions and in suitable soil environs where some sort of settlement was possible. In India evidence of such sowing and later reaping in different neolithic sites, traces beginning of settled agriculture during that period. More or less simultaneously with the cultivation of crops and domestication of animals also came into practice as an aid to agricultural operations. Agriculture thus embraces two-fold activities: raising of crops involving a number of practices and domestication of animals.

The present paper concentrates on the state of agricultural practices in the Vedic period presumably started from c.1500 BC and ended in c.500 BC, corresponds to last phase of the Chalcolithic period and Iron Age in India. The

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possible sites stretched from north-western parts of India to the entire alluvial of the river Ganges.

The associated factors with agricultural practices in Vedic India to be included in the present study are: (i) Soil, land and village settlement; (ii) Manure and manuring; (iii) Crop husbandry inclusive of plant protection measures, agricultural technology and agricultural implements; (iv) Irrigation system; (v) Animal husbandry and (vi) Meteorological observations in relation to crop prospects. The entire account has no treatise like approach but projected mostly through sacerdotal matters.

The Vedic Āryans pursued pastoralism and agriculture as the mainstay of their livelihood. According to Max Muller the term *Ārya*, derived from the root, *ar*, to stir, i.e., stirring of soil by means of stick or plough, shows Āryans were cultivators¹ before separation as Indo-Iranian and Indo-Aryan. The Vedic Āryans for their existence on Indian soil had to fight against many obstacles. Appeasement of natural phenomena in form of anthropomorphic deities for existence and prosperity made them close to nature and natural objects.

Analysis of related data on agriculture contained in the Vedic texts shows three prominent phases. The early phase shows struggle for fertile field. The twin god *Dyāvā-pṛthivī* is extolled for snatching fertile field from the *dasyus* or Non-Āryans and granting to the Āryan people.² Agricultural pursuits were thus not very easy for the Vedic Āryans at the early stage. Prayer to different godheads for copious rain and other favourable conditions congenial for raising of food crops (*anna*) and animal resources is frequent in the *Ṛgvedic mantras*. Agriculture occupied such an important place that *Sūrya* was conceived as having three bonds in three *lokas*. His bond in water, i.e. habitable world, explained by commentator Sayana are tillage, rain and seed.³ Thus in this hymn Vedic idea on three essentials of *Kṛṣi* (agriculture) is presented through this imagery of *Sūrya* in form of *Aśva*. A very few grain-crops are mentioned in the *Ṛgveda*. *Yava* (barley) is one among them. Obviously this shows the particular settlement area of the people at that time was favourable for cultivation of *yava*. Divinity was imposed on every conditions of nature. The entire agricultural operations were given a spiritual domination. This is found in the idea of *Kṣetrapati*, presiding deity of agriculture, indicating either *Rudra* or *Agni*, supervising all the agricultural activities.⁴

The second phase from the Yajurvedic period when eastward movement of the Vedic people started, shows advancement in crop-production. Yajurvedic texts mention a number of grain crops and other crops. Extollation of nature and other elements found ritualistic application. So also came black rites in form of charms for protection of field crops and cattle from harmful elements or natural phenomena as well as for their prosperity during Atharvavedic period.

All these things were culminated in the development of ideas about spirit of agriculture and vegetation and guardians of furrow. The agricultural spirits were specially propitiated and worshiped at the time of sowing of seed, reaping and storing in threshold.⁵ A tinge of magic practice is explicit in the third stage, i.e., in the *Sūtra* period.

Agriculture in the Vedic period was thus a religio-social activity with all its ancillary aspects from soil to weather forecasts.

SOIL, LAND AND VILLAGE SETTLEMENT

Farming first requires fertile soil. Cultivation areas in different phases of history are thus traced to fertile soils, like, mountain clay, alluvial soils of river-plain and black cotton soil particular only to Deccan trap adjoining some parts of Central and Western India.⁶

Divisions of Soil and Land

Vedic settlement at the early part was on the basin of river Indus. The fertile lower basins of seven Punjab rivers were highly esteemed for bounteous crops.⁷ River sides were considered fertile. In their eastward movement the Vedic people are stated to have selected their routes of journey by the river-sides. The *Ṛgveda* recognizes two types of land. These are fertile or *apnasvatī* and arid or *ārtanā*.⁸ The former is marshy or riverine tract, known as *anūpa* and the latter, arid, known as *jāṅgala* in post-Vedic period. *Ūṣara* (alkaline) and *anūṣara* (non-alkaline, i.e., cultivable land), the two divisions of land are found in the later Vedic texts or *Sūtra* literature.⁹ Post-Vedic period however introduced artificial divisions of land. Pāṇini categorized these lands on the basis of suitability for the growth of particular crop or on the capacity of production of crops of some specific measurement.¹⁰

Conservation of Soil

Maintenance of soil's potentiality was a matter of deep concern to the Vedic agriculturists. It was generally performed by alternate use of arable land as fallow and as cultivable field for lessening constant pressure on field. *Kṣetra* and *khila* or *khilya* are the two terms for arable land and fallow land.

The arable land was surrounded by grassy land. It was also a type of fallow land mostly used for pasturing of cow. Fallow land was usually in the middle position between two arable plots. It was not unfertile but it required proper excavation by ploughing. The *Ṛgveda* mentions one type of fallow land which was not broken or ploughed (*abhinna khilya*).¹¹ The fallow land had different functions: pasture ground and ground for cowshed.¹² Both the practices contributed natural fertilization of the soil by cow droppings.

Reclamation of Land

Reclamation of land was making wasteland usable for cultivation. Burning and cutting of growth of vegetations in wasteland and preparing the plot for cultivation was not unknown to the Vedic people. The *Ṛgvedic* account of burning of land and growth of new vegetation testifies this practice.¹³ A graphic account of reclamation of land with the eastward movement of the Vedic people is found to occur in the *Śatapatha Brāhmaṇa*.¹⁴ Obviously the lands falling on journey route of the Vedic people became new agricultural zones. Expansion of agriculture from Punjab river basins to *Madhyadeśa* and onwards upto river *Karatoyā* in eastern side was not improbable.

Village settlement

A village settlement had its growth with the beginning of settled agriculture. Soil and water were the two essential factors on which depended the growth of village settlement. According to Patañjali village (*grāma*) in a restricted sense, signified "an assemblage of several huts", or in a wider sense it means "a village with its forests and bushes, with its boundaries (such as rivers and hills) and with embanked fields."¹⁵ As basic unit for agricultural produce, this settlement type either in form of stock-raising or in form of crop-raising or in forms of two are evident in different neolithic and chalcolithic sites in India. They were in different sizes with different populations estimated from number of huts, unearthed in excavations.¹⁶ *Grāma* in the *Ṛgvedic* period appears to be an agrarian centre

inhabited by a few families of the same clan bound by kinsmanship.¹⁷ The inhabitants were mostly pastoral people and the tillers of soil.

Village composition

Village had adjoining wide fertile uncultivated land having the wilderness of forest (*araṇya*). It was used as pasture ground of domestic animals. The village itself contained home (*amā*) or homestead land which is stated as different from adjoining wide land (*araṇya*) and arable land inclusive of cultivated and cultivable lands lying fallow (*kṣetra*, *khila*, *urvara*).¹⁸ The adjoining wide land was plausibly used as cultivable land when expansion of agriculture was needed. This type of village composition was also common during Buddhist period.

In the next phase of the Vedic period from 1000 BC known as Iron Age in history, village settlement was not confined to river beds only but scattered in river tracts getting the facilities of cultivable land from the clearance of jungle by sharp cutting tools. The economic basis of these settlements became agriculture, animal husbandry and iron technology.

Two types of village settlements came into existence. These were scattered and closed together. Villages on the eastern side were generally closed and populous. Presumably this was due to extensive utilization of rising sun for cultivation work.¹⁹ Big forests therefore grew up in the western side. Grass land for pasture and granary were the common properties of the villages.²⁰

The later Vedic period shows villages started to be used as administrative units in addition to agricultural unit. The Buddhist period, contemporaneous to this period gives evidence to villages becoming a tiny self-governed republic.²¹

MANURE AND MANURING

Sweetness of atmospheric water and sweetness of soil were the two cravings of the Vedic people. Sweetness is intended to mean here fertility of soil and good water resources. The plant fertility depends on three factors: a) Conservation of top soil, b) Replenishment of soil exhaustion and c) Manuring of individual plant. Of these three, removal of soil exhaustion was possibly considered the best way to restore soil-fertility.

Two measures were adopted:

- (i) **Manuring:** Manures of animal origin for the fertilization of soil was well recognized in the Vedic society. The *R̥gveda*²² recommends blood of cow and cow-dung (*śakṛt*) for restoration of earth's youthfulness in a symbolic way of description of restoration of youth of the aged parents, heaven and earth by *R̥bhus*. According to some this is a clear indication of nitrogen fertilizer for the removal of soil-exhaustion.²³
- (ii) **Rotation of Crops:** The idea of rotation of crops revealed in the statement "Corn ripens twice a year"²⁴ throws light on cultivation of grain-crop followed by cultivation of legumes, the only restorative plants fix nitrogen in the field which is exhausted with cultivation of grain-crop.²⁵ Obviously rotation of crops was made between two types of crops, grains and legumes. Kosambi observes for obtaining proteins in forms of peas, grams, pulses, beans the practice of crop rotation was followed.²⁶ Kauṭilya in the *Arthaśāstra* spoke also about a third crop.²⁷

The next phase in the Vedic period is marked by other types of manuring in addition to the those prevalent in the earlier period.

Animal manures

These included use of two varieties of cow-dung manures, stable (*goṣṭha*) and farmyard cow-dungs.²⁸ Excrements of animals (*purīṣa*) were also recommended for this purpose.²⁹

Green manure

Pieces of wood of *Terminalia arjuna*, husk of barley and blossoms of sesame are found to have been recommended for removing defilements from arable land.³⁰ This may be taken as an instance of the practice of green covering of fields. The same practice is recommended by Varāhamihira in 6th Century AD³¹ Reference to husk of barley and wood of *Terminalia* shows fixing of nitrogen to soil.³²

Manuring of seeds of Yava

The late Vedic period introduced manuring of *yava* (barley) seeds with clarified butter and honey as pre-sowing treatments of seeds.³³ The *mantras* uttered for this practice are laid down in the *Atharvaveda*.³⁴ In the third century

BC Kauṭilya described elaborate functions of pre-sowing fertilization of seeds and plants as a part of manuring.³⁵ Application of manures to the field is not clearly stated in the *Samhitās*. These are described mostly in the *gṛhya* ritual. Extollation, charms and spells form also a part of the practices.

CROP HUSBANDRY INCLUSIVE OF PLANT PROTECTION MEASURES, AGRICULTURAL TECHNOLOGY AND AGRICULTURAL IMPLEMENTS

Crop Husbandry

Plant husbandry implies intentional sowing or planting for the production of desirable crop plants. This intentional sowing or planting is known as “plant domestication”. The practice of domestication of plant which appears to have been a part of agriculture in India, as elsewhere, is more discernible from the analysis of wild ancestors and the related cultivars. The entire assemblage of Vedic crops, show in two places, wild ancestor and cultivars. These two are *yava* (barley) and *yavasa* (ancestral grass of barley), *gārmuṭ*, wild bean, its particular cultivated variety however has not been mentioned.

Alongside elaborate cropping operations, sacrificial performances were also carried out.³⁶ On some occasion affinity is established between the things of agricultural importance and of sacrificial importance. Thus we find “grains ripe twice in a year” and “twice baking of earthen sacrificial vessel, *ukhā*.”³⁷

Crop Pattern in the *Ṛgveda-Yajurveda* Period: Vedic Chalcolithic Period

*Yava*³⁸ (barley) was the only cultivated crop in the *Ṛgvedic* period. According to the story contained in the *Atharvaveda*³⁹, *yava*, the sweet corn was first cultivated by the gods on the bank of river Sarasvatī for the benefit of mankind. The great *Indra* was the furrow master and the *Maruts* were the ploughmen. Association with *Indra* and *Maruts* suggests it as a rain-growth corn. Its related wild ancestor, *yavasa*, is frequently mentioned in the *Ṛgveda*. This wild ancestral grass was cow’s fodder.⁴⁰ Occurrence of *yava* and *yavasa*, i.e., cultivar and its related ancestor testifies domestication of plants were not unknown to the people. *Tokman*, a variety of *yava* is identified as “oat”.⁴¹ The *Ṛgveda*⁴² describes *yava* as rain-fed crop. The *Taittirīya Samhitā*⁴³ refers it as summer crop.

Ṛgvedic people’s deep attachment to *yava* was due to their association with Indo-Iranian people prior to their settlement on Indus basin. This is indicated

by the similar expressions “*yavam kṛṣ*” and “*sasya*” in the *R̥gveda* and “*yao karesh*” and “*hahya*” in the *Avesta*.⁴⁴

Yajurveda (c. 1200 BC)

The Yajurvedic period shows cultivation of varieties of crops. Presumably that happened due to expansion of Vedic Āryan’s settlement region. From North-western India and Punjab it gradually expanded towards Ganges basin. New climatic zone and favourable land and soil facilitated agricultural pursuits. Alongside developed ritualistic performances for satisfactory cultivation of crops and increase of cattle resources. The *Cāturmāsya yajña*⁴⁵ or four monthly sacrificial rites were held at the beginning of the three seasons of four months each. These were carried out as preventive and expiatory rites. The four rites were known as *Vaiśvadeva*, *Varuṇapraghāsa*, *Sākamedha* and *Śunāsīra*. Two among these four rites, *Varuṇapraghāsa* and *Śunāsīra* had direct link with agriculture. The former held in the rainy season was carried out for rain, winning of food and increase of procreation of flocks. The latter, *Śunāsīra*, which means ploughshare and plough, according to Oldenberg, was an offering to the “geniuses of the plough to secure its good working.”⁴⁶ Not only this, symbolic agricultural activities were pursued on sacrificial ground with the purpose of successful crop-raising. Wide varieties of seeds were sown for varieties of crops raised in the same field.⁴⁷ More interestingly offering to crops was a part of sacrificial rites so that these could be successfully cultivated. This helps us to know about the wide range of cultivated crops known in the Yajurvedic period.⁴⁸ Craving for cultivated (*kṛṣtapacyā*) and uncultivated (*akṛṣtapacyā*) crops mentioned in the sacrificial rites shows equal importance was given to the uncultivated crops. Uncultivated crops were wild crops species.⁴⁹ Possibly these were used for hybridization with cultivated species for getting new variety of cultivated crop.

Places of composition of five Yajurvedic texts, one white *Yajurveda* and the other four associated with black *Yajurveda*, cover Central India, Gujarat, North-eastern and Eastern regions, Kashmir and Punjab. A more or less similar crop pattern is found prevalent in those regions.

Crop Specimens⁵⁰

The host of crops scattered in the Yajurvedic texts show the presence of cereals, legumes, oil seeds, fibrous plants, fruit crops and green vegetables.

Cereals:

(a) Rice (*vrihi*): Four cultivated varieties, viz. black (*kr̥ṣṇa*), white (*śukla*), quick-grown (*āśu*) and *mahāvrihi* (large grained). The last two varieties were confined only to central India. The quick-grown variety appears to have been known as *ṣaṣṭika* (ripens within sixty days) in the later periods.

(b) Wheat (*godhūma*);

(c) Barley (*yava*), and a species of it, *upavaka*;

(d) Millet (Panic seeds) viz. *aṇu* (*Panicum millicium*), *priyaṅgu* (*P. italicum*), *śyāmāka* (*P. frumenataceum*).

Legumes:

Four varieties, viz. bean (*māṣa*, *P. munga*), three types of pulses (*mudga*, *P. radiatus*; *khalva*, *Lathyrus sativus*; *masūra*, lentil, *Les esculentus*). Reference to wild bean (*gārmuṭ*) shows nativity of beans in India.

Oil seeds:

Sesame (*tila*); Fibrous plant, cotton (*kārpāsa*, *Gossypium herbaricum*); Fruit crops, viz sugarcane (*ikṣu*), cucumber (*ūrvāruka*), date (*kharjura*); Green vegetables, viz. bottle-guard (*alābu*, *Lagenaria vulgaris*).

Atharvaveda inclusive of other Vedic Texts: Iron Age (c. 1000 BC – c. 500 BC)**Crop specimens:⁵¹**

Excepting absence of wheat the other cereals are same as with the previous period. A new variety of millet (*sāṇḍadūrvā*, ie., millet having egg-shaped roots) is found to occur. Notable crop is mustard (*ābayu*) in two varieties, viz. white and brown (*piṅga* and *baja*). The appearance of mustard is worth-noting in this period after the pre-Harappa and Harappa Chalcolithic period. Mustard was an important article in black rites. Its cultivation seems to get incentive for this cause also.

Two other crops are to be mentioned. These are: 1) Intoxicating drug crop: *Bhaṅga* (the flower of *Cannabis sativa*) became a cultivated crop. The

continuity of cultivation of *bhaṅga* is found to occur in the subsequent periods, particularly during medieval period for its use in medicinal preparation.⁵² The other is fibrous crop *śaṇa* (hemp, *Crotalaria Junacea*).⁵³

Among the other *Brāhamaṇas* and some later texts mention, in addition to other crops reported from texts of the earlier phases, red variety of paddy (*hāyana*), bean (*kulattha*, *Dolichos biflorus*), castor-oil (*eraṇḍa*, *Ricinus communis*), myrobalan (*āmalakī*, *Embllica Officinalis*).⁵⁴

Excavation reports from different Iron Age sites also show flourishing state of rice, barley and wheat cultivation in different places of U.P. Rajasthan, and legumes (*Dolichos biflorus*) in Southern India.⁵⁵

Ecological Basis of Crops

The Vedic sources furnish a very sketchy idea about crop characteristic of particular region. Crop-pattern is generally affected from regional variations of climate and soil. The foreigners' accounts are helpful in this matter. Seasonal correlations with crops are enumerated in the *Taittirīya Saṃhitā*. It presents a small crop chart containing four crops and their associated ripening seasons: hot season for barley; autumn for rice; winter and cool season for beans and sesame. Barley ripened in summer was sown undoubtedly in winter as in present day. Likewise rice ripened in autumn used to be sown in the beginning of the rains. Beans and sesame planted at the time of summer rains were ripened in the winter and the cool season.⁵⁶

Regarding barley, *Ṛgveda* describes it as rain-loving plant. Whereas another Vedic text describes barley belonging to the beginning of year, ie., spring. The three different seasons, inclusive of hot season stated above for barley may imply regional variations.

Plant Protection Measures

The *Ṛgveda-Yajurveda* period also adopted some preventive measures to protect plants and crops. These include method of driving away the pest-bird by din and noise. The *Ṛgveda*⁵⁷ thus describes, "Like the farmers make noise to drive away the birds from fields".

The other preventive measure was cultural control by rotation of crops. The *Taittirīya Saṃhitā* refers to rotation of crops. Obviously that practice also afforded natural prevention of crops from insect-pest.⁵⁸

Excepting bird no other pestiferous agents were known in the preceding period. A host of such elements infesting grains in the field and unfavourable natural phenomena causing harm to crops came to be known during the Atharvavedic period. The pests inclusive of natural phenomena were.⁵⁹

- a) Borer (*tarda*) indicating either insect or bird, hooked insect (*samañka*), noxious insect (*upakvasa*) and locust (*patañga*),
- b) Rodents (*vyadvaras*) and rats (*ākhu*)
- c) Reptiles
- d) Natural phenomenon like lightening and sun. Charms and spells formed the preventive and remedial measures.

The late Vedic period introduced weed as pest in addition to those recognized in the *Atharvaveda*. Weed was particularly wheat-pest. Preventive and remedial measures were charms and spells in association with some substances appear to have pesticidal effects. These include: a) spreading of lead after furrowing, b) burying in field the metabolic product (grass) from the bowels of sacrificed cattle and some parts of particular plant substances.

Weed control was also recommended by burying of several plant-substances in the fields before sowing of seeds.⁶⁰

Agricultural Technology

Agricultural operations involving crop production comprised soil-preparation inclusive of tillage and fertilization, cropping system, harvesting, crop-processing and preservation. Among these fertilization is already reported:

Tillage (*kr̥ṣi*):

- (i) Ploughing was generally performed with the help of oxen in teams of six, eight or twelve. Ploughing was also done with the help of one or two sheep. There was also the practice employing a maid for this purpose. Symbolic use of tilling operation in which six oxen are equivalent to six seasons and twelve oxen stand for twelve months and thus signifying twelve months preparation of sacrificial ground for the fire (*agni*).⁶¹
- (ii) Furrow marks were made in grid pattern: Twelve lines made by plough drawn by twelve oxen were arranged in such a way that three lines arranged

vertically, three running over them horizontally and the other six made crisscross.⁶²

(iii) Mowing (*matyam*) was the post-plough operation.⁶³

Cropping System:

It includes sowing of seeds of different kinds in grid-pattered furrows⁶⁴ and the methodology adopted for rotation of crops.

Reaping, threshing, winnowing and storing are the post-cultivating processes, noticed from the period of the *R̥gveda*. The *R̥gveda* (x.101) presents a picturesque description from ploughing to reaping inclusive of irrigation. All the operations were carried out with laudatory song to the *Viśvadevas*.

Reaping was done with the help of sickle (*śṛṇī*) when the corns ripe. Thrashing the bundles of grain-stalks on the floor of granary (*khala*) and winnowing in winnowing-baskets (*sthiṇī*) were the different post sowing operations mentioned in the *R̥gveda*. The *Atharvaveda* refers winnowing fan (*śūrpa*) in this connection. Grains (here barley) were stored in a vessel (*urdara*).⁶⁵

Agricultural implements

All the agricultural operations were carried out by implements suited to them. The artefacts and innovations were moulded according to the nature of soil, dimension of cultivable field and above all techniques involved in particular operation. Vedic implements show four types of implements. These are:

Forest-clearance tools: Axe (*svadhiti*, *paraśu*) and axe type tools are mentioned as tool for cutting wood in the *R̥gveda*.⁶⁶

Soil-treatment:⁶⁷ The *R̥gveda* refers to mower (*dātā*) for grass-cutting which might be taken as pre-tilling performance of the soil. The *Taittirīya Saṃhitā* brought into notice the use of roller for making field even for tilling.

Tillage implements: The plough⁶⁸ described in the *R̥gveda* is characterized as traction plough.⁶⁹ The Vedic plough is distinguished by:

- a) two types: *lāṅgala* (small plough) and *sīra* (heavy plough).
- b) four parts:⁷⁰ plough i.e. indicating the rod (*lāṅgala*, *sīra*), the rope (*varatra*), share (*phāla*), and yoke (*yuga*). The latter is however absent in some descriptions of plough which indicates a particular type in which the plough

itself is fastened to the animal body instead of being tied to the yoke. The *Yajurveda*⁷¹ describes plough as lance-pointed, well-lying and furnished with a handle (*tsru*).

- (c) Animal power dragging the plough:⁷² Oxen, sheep and camel were harnessed for dragging the plough. Number of animals varied according to the dimension of plough. Six, twelve, twenty-four formed different animal strength in the dragging of plough. Mention is also made of dragging of plough by one and by two sheeps.

Harvesting tool: Three types of corn-cutting tools are found to occur in the *R̥gveda*.⁷³ These include: *dātra* (a sort of sickle in the shape of crooked knife), *śṇī* (sickle) and *jetā* (reaping hook).

Corn-cleaning equipments: The sieve and winnowing fan mentioned in the *R̥gveda*, were probably used for this purpose.⁷⁴

Transport for carrying agricultural products: Two types of carriers, viz *anāsa* (carts) and *śakaṭa* (wagon) were for commercial types. The former was two-wheeled, made of woods of *Acacia* and *Dalbergia* with bamboo poles and wheels rimmed with metal tyre (*pavi*). The latter was also wooden body and especially meant for carrying agricultural products from the field. The chariots, in addition to those two were used for carrying agricultural products from the field. Animals employed for drawing these carriers were ox, stallion, ram and dog.⁷⁵

IRRIGATION SYSTEM (SĪNCANA)

Two types of irrigation were known to the Vedic people.

Natural irrigation:

Rain water

Vedic agriculture was essentially rain-supported practice. The *R̥gveda* contains a large number of *mantras* applauding rain for 'anna', food-grain and increase of flock of cattle⁷⁶ (*jīvadhanyā*). Specific utilization of rain-water for flowing over arable land is laid down in the *R̥gveda*.⁷⁷ Small streams are stated to have formed from rain-water. These streams had no flow and water for irrigation was lifted by means of bucket (*dronī*).

River water

Two important river sources supporting irrigation were Sindhu, its seven tributaries and Sarasvatī.

Sindhu (Indus): It was snow fed river from north-west side of mount *Kailāsa*. It was a source of perennial water. Its other stream originated from a lake, north-east to *Kailāsa*. The two flowed north-westerly and taking south-westerly course falls in Arabian sea.⁷⁸ The *Ṛgveda* describes Sindhu with its associated streams in two courses, easterly and westerly. The easterly course comprises the Punjab rivers, the westerly course includes its Kabul streams.⁷⁹ River *Sindhu*⁸⁰ is described as flowing over the region rich in corn. It is described as *Vājīnīvatī* (embodiment of food). All the statements show high fertility capacity of the river-water. The seven rivers of *Sindhu* flowing on their downward path, impart fertility to field, and thus the Veda states “increase *anna*” (food-grain).

*Sarasvatī*⁸¹: Sarasvatī, the non-perennial rain-fed river, having risen in the valley of Siwalik range, according to geomorphological investigation, changed its course five times in its entire course from emergence to fall in the Arabian sea. The two sources of water of the river were i) rain-fall and ii) draining of water from the rivers of perennial water, namely, Indus, Sutlej and Yamunā. Thus the shifting of course of Sutlej towards north-westwards made Sarasvatī to flow in sub-soil at Vinasāna.⁸²

Contribution to Irrigation: Sarasvatī by its rich water resources is found to have sustained to a great extent irrigation in a wide area of north-western India from Punjab to Sind including Rajasthan and Saurashtra while traversing the regions in course of its different flows.

Two-fold contributions of river Sarasvatī to irrigation: i) by surface flow, and ii) by sub-soil flow.

- i) **Surface flow:** Sarasvatī is described as having high spate possibly due to torrential rain. Inundation with copious flow of water is clearly stated in the hymn of the *Ṛgveda*.⁸³ The statement like “Sarasvatī with all her kindred rivers come to this grass” also occurs in the *Ṛgveda*. All these are indicative of the draining the land of a larger area and ensuring cultivation.⁸⁴
- ii) **Sub-soil flow:** The sub-soil flow was a perennial sources of water to dug-well. In all probability well-irrigation was widely practiced in Rajasthan due

to availability of pockets of such water under the sandy ground. The *Ṛgveda* in one *mantra* records flushing of water when the adjoining ground of river Sarasvatī was dug.⁸⁵

In natural irrigation river water was distributed over arable field by means of channels. In one *mantra* of the *Ṛgveda*, Varuṇa is requested to make paths for the flowing of river water over the field.⁸⁶

Artificial irrigation:

Two devices were prevalent. These were non-flowing streamlets formed out of rain water, and the water was poured on arable field out of these storages by means of *dronī* (wooden bucket).⁸⁷ The other was well-irrigation.⁸⁸ The well was nearby to the field. Water was lifted with the help of buckets fastened to the stone-wheel by means of straps. The entire operation seems to have been performed by the rotation of the stone wheel. The *Ṛgveda* thus describes:

“Arrange the buckets in their place; securely fasten on the straps. We will pour forth the well that hath a copious stream, fair-flowing well that never fails Pour forth the well with stone wheel” (X.101.5,7 Eng. Tr. Griffith).

The same procedure of lifting of water with a series of buckets stung one after another also occurs in the *Ṛgveda*.⁸⁹ The *Arthaśāstra* describes it as *udghāṭam*.⁹⁰ The *Ṛgvedic* pot-wheel, as the later records describe, consisted of a row of earthen pot tied to the rim of a drum shaped wheel turning into a vertical plane over water. The wheel, having spokes (*ara*) was worked like a capstan. It was moved by gearing a horizontal wheel turned by man or beast to the vertical water hoist.⁹¹

Irrigation by dam or reservoir was introduced in the Yajurvedic period.⁹² All these devices are more or less common to the proto-historic Harappa period. The well-irrigation was however Vedic innovation.⁹³

The next phase of the Vedic period, i.e., period of the *Atharvaveda* gave more stress on rain-water for irrigation.⁹⁴ Utilization of river-water by diverting its course in channel became prominent. The *Atharvaveda* states

“Here, ye water, is your heart, here is your calf, ye righteous ones! Come ye, mighty ones, by this way here, by which I am conducting you here” (*Atharvaveda*, III.13.7 Eng. Tr. Bloomfield)

The urgency of channelizing river became so essential that charm and spell were applied for conducting the course. *Kauśika-Sūtra*,⁹⁵ the *Gṛhya sūtra* of the *Atharvaveda*, describes the associated ceremonial rite for achieving this goal. Canal-irrigation is thus envisaged widely used system during the period. The *sūtra* period shows large-scale use of artificial irrigation by well and reservoir-dam.⁹⁶

ANIMAL HUSBANDRY

Animal husbandry or domestication of animal though developed widely with the flourish of cultivation of crops, its beginning is traced in prehistoric period of mesolithic and neolithic sites in India.

For three reasons animal husbandry was encouraged as part of agricultural practices: for carrying loads (as beasts of burden), for protecting agricultural produce, and for productive values needed either for agricultural operations as manure or as supplement to food from cultivated crops.

The Vedic-chalcolithic period was pre-eminently a period of cattle-culture. The other domestic animals,⁹⁷ specified in the *Yajurveda*, are horse, mule, ass, sheep and goat. The *R̥gveda* concentrates on cattle, horse, sheep and goat. Dog is also mentioned in this text as a draught animal. Breeding, rearing and tending as different components of domestication of animals are discussed in the Vedic texts. Different breeds of cattle were identified by particular markings on the ear given by the cattle-breeders. These markings also helped in the selection of suitable partners for mating.⁹⁸

People in general were familiar with the different breeds of cattle. They had their respective requirements in agricultural economy. Among them two were prominent: milch cattle (*dhenū*) and draught breed (*anaḍvān*).⁹⁹ The other required breeds were those that had early maturity and mating capacity. The *Yajurveda*¹⁰⁰ recognizes a particular breed which attained physical maturity at the age of five. The later-vedic age shows proficiency in producing particular cattle-breed attaining mating capacity at the age of three or four.¹⁰¹ The wild ancestors of domesticated cattle were known as *gaura* and *gayāl*.¹⁰²

Breeding was also practiced with regard to other domestic species. Breeds were known on the basis of breeding regions. Horses of Indus and Sarasvatī were highly esteemed and so was also the sheep of Gandharva-breed which had high food-producing capacity.¹⁰³

Nourishment of cattle by feeding green grass, water and barley is recommended in the *R̥gveda* for increase of milk-yield.¹⁰⁴ Proper penning in two types of pen, open pasturage (*goṣṭha*) and cow stall (*gośāla*) and three regular occasions of pasturing were performed for the welfare of cattle-property.

Utilizations of animal power¹⁰⁵ in agriculture are evident in the following practices: (i) ploughing by oxen and sheep, (ii) transportation of agricultural produce by carts drawn by oxen, stallions, rams and dogs, (iii) carrying water to field, and (iv) use of animal manures consisting of blood of cow and cow-dung. The Iron Age or the period of the later Vedic texts gave much incentive to cattle breeding. Raising of stud-bulls by special feed consisting of salt and other substances is mentioned.¹⁰⁶ Cattle-breeding became a religious rite. Not only much attention was devoted to the breeding, rearing and tending of domestic animals, cattle-diseases were given proper attention and generally cured by the application of a medicinal plant, *sahadevi*¹⁰⁷ (a variety of *Sida cordifolia* with yellow flowers).

In agriculture cow-dung as manuring substance and clarified butter and honey as fertilizing substances for seeds in pre-sowing treatment are notable. The extensive use of honey for this purpose implies bee-culture.¹⁰⁸

METEOROLOGICAL OBSERVATIONS IN RELATION TO CROP PROSPECTS

The study of the correlation between weather and heavenly phenomena and their impact on crop prospects was a part of agricultural activities. Prior of the Vedic period we have no record of this type of practice, excepting a few instances. Development of this idea is noticed during the Harappa period in regard to several heavenly bodies which were believed, not only in India but also elsewhere, to be rain-bearing agents. These are *Mṛgaśiras* (Orionis), *Kṛttikā* (Pleiades) and Venus.¹⁰⁹ In all probability these heavenly bodies got predominance as indicator of seasonal rainfall, cultivation of crops other than barley and wheat, and growth of fish-crops.

The idea of correlation between seasonal rainfall and associated heavenly phenomena is explicit in the Vedic period. Crop prospects began to be studied in relation to seasonal rain, fogginess and dew under the influence of heavenly bodies.

Rainfall: The *R̥gveda* recognizes two seasons of rainfall, associated with summer solstice and winter solstice.

The summer solstitial rain or the monsoon rain is found to have three showers. *Indra*, the particular solar power, is believed to represent the summer solstice¹¹⁰ and he activates various downpours in this part of the year. The early shower was predicted from the disappearance of *Vṛtra* (constellation Hydra) and the rising of two stars: *Aja-ekapāt* (Pegasi) and *Ahirbudhna* (Andromeda).¹¹¹

The second of the rain was supposed to have been caused by the impact of the star *Apām-napāt* (= *apāmvatsa* of later period, Virgo).¹¹² Several heavenly bodies are found associated with the concluding part of the rains or the autumn rains. These include influence of the Sun during its passing to the other house, the disappearance of the constellation *Tiṣya* (Praesepe) associated with the heliacal rising of Jupiter in the autumn equinox (*Varuṇa*) and the rising of *Puṣan* (Auriga) in the western horizon along with *Aśvinī's* (Arietus) and the rising of the constellation *Apa* (= *Pūrvāṣāḍha*, Sagittarius).¹¹³

Effect of rain on crops and livestock: The summer solstitial rains was believed to produce sweet juice in corn and to increase the procreative power of cattle.¹¹⁴ The downpours also contributed to the growth of standing crops (at the early part of the rains), of annuals both flowering and fruit-yielding, and of several varieties of crops.¹¹⁵

In the winter solstitial rains the principal rain-making agents were the twin stars *Aśvinī's*. Their association with the cool season is clearly specified in the *Ṛgveda*.¹¹⁶

Effects on crops of rainfall and dew formed under the influence of the twin stars: Rainfall under the impact of the twin stars, particularly at the time of sowing seeds,¹¹⁷ was considered to be highly favourable for cultivation of barley (the winter crop). Growth of sweet juice in plants caused by dew is recorded and this was therefore the period when bees collect honey.

Unfavourable weather for crops: The *Ṛgveda* describes the particular foggy condition that forms in the extremely cold winter night and persists till the morning as harmful for the cultivation of barley crops (*ku-yava*).¹¹⁸

Apart from meteorological speculation, the ideas about intersection between heavenly bodies, crops and livestock are also pointed out. Power of procreation and warding off germicidal effect from cattle body and nourishment to crops are attributed to *Puṣan* (Auriga), *Tvaṣṭr*, *Aśvinī* (Arietus) and *Rudra*.¹¹⁹

Heavenly bodies as rain-making agents find full support in the Yajurvedic period when constellations were known by specific names and not in the form of divinities. *Kṛttikā* in this period is recognized as multitude of seven stars, the three among them stand for rain-making phenomena in the firmament.¹²⁰

The *Atharvaveda* is concerned more with the healing virtues of asterisms. The twin-starred constellation *Vicṛta* (Scorpion) is attributed with the power of curing “lingering diseases” (*Kṣetriya*) in cattle body.¹²¹

That asterisms are beneficial for agricultural practices are fully recognized in the later Vedic texts, ie., the Sūtra literature. These asterisms were *Uttara Proṣṭhapāda* (Andromeda and Pegasi), *Uttara-Phālguni* (Leonis), *Rohiṇī* (Aldebaran) and *Jyeṣṭhā* (Antares).¹²² In the later period, the *Bṛhat-Saṃhitā* of Varāhamihira discusses in detail the asterisms that are beneficial for crop cultivation.

The entire discussion on agricultural practices in the Vedic period highlights some notable facts as under:

- I) Green-manuring in soil fertility is a process that has continued from the Atharvavedic period till today.
- II) Animal husbandry as a part of agricultural activities and the weather lore on crop prospects predicted on the basis of position and movement of heavenly bodies show that farming was a composite and comprehensive activity concerned not only with soil, irrigation, agricultural implements and the like, but also with the study of heavenly bodies.

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