

**AGRICULTURE
IN
ANCIENT INDIA**

**Papers Presented at the Seminar
Conducted on
Saturday, 25th April, 1992
at Thane, under the auspices
of the Institute for Oriental Study, Thane.**

Institute for Oriental Study, Thane

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**Edited by
Dr. Vijay V. Bedekar**

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Preface

I am extremely happy to give you this volume containing papers presented in the Seminar - *Agriculture in Ancient India*, held on Saturday the 25th April, 1992 at Thane, under the auspices of the Institute for Oriental Study, Thane.

The Institute for Oriental Study, Thane, is a voluntary organisation working for the promotion of Indian culture and Sanskrit language. Organising international seminars on different facets of Indian culture is one of the objectives of the Institute. To achieve this goal, we have conducted so far 16 Seminars on different subjects of Indian culture.

The subject *Agriculture in Ancient India* for the Seminar to be held was announced one year in advance i.e., on the occasion of the preceding Seminar held in April, 1991. After the announcement of the topic *Agriculture in Ancient India*, we were literally showered with letters of inquiry and we were assured of contributions from all parts of India and abroad. This may be the first time probably, this subject in its totality was discussed by scholars. About 20 papers were selected for presentation and those are included in this volume.

Agriculture has remained a vital human activity in this continent for ages. There is adequate literary and archaeological evidence to suggest that the art and science of agriculture was known to this civilization at least for the past five to ten thousand years or perhaps more. This passage of time enriched their own experiences of this art and paved the way for systems and methods, practices and solutions for a safe agriculture. The system of commons, crop rotation, manuring, use of suitable animals and judicious use of natural resources

like water, cannot simply be accidental but achievements of experimentation, failures and successes. Whatever may be the technology they evolved, one thing we can certainly say is that their system of agriculture with the techniques evolved by them could feed the population of their times without damaging the earth, without endangering any species, without destroying forests, without polluting water sources and without polluting the environment to a point of no return. There was not a system of production for consumption having no regard to their surroundings.

Before the advent of the 19th century or after the agricultural revolution achieved by technological aids like tractors, bulldozers and other engineering marvels, use of inorganic fertilizers and pesticides and manoeuvring rivers with massive dams in the 20th century, we have qualitatively and quantitatively altered our earth, forests, rivers and environment than what we had inherited from our forefathers prior to the 19th century. The cost we have paid to achieve the success today in agriculture is evident from the ecological and scientific data we possess today. The question is Do we have any right to bequeath such plagued planet earth to posterity?

The success stories of production achievements have absolutely no relation to the feeding of the billions of hungry mouths. It is high time that we come out of the intoxication of the so-called success stories and audit the successes against ground realities of irreparable damages we have caused to the natural non-renewable resources. Nearly 4.7 to 2 billion tons of top soil is eroded each year. It takes nearly 50 years to build one centimeter of it. Our water table is going down, salination of the soil is increasing, our disrespect to forests has brought monsoon to an unreliable and unpredictable season, our use of nitro fertilizers has altered the nitrate contents of ground water. In these circumstances, can we really call modern agriculture a success story?

This seminar was an attempt to peep into our ancient literature and to know how our ancients fed their population. This is just a humble beginning and by no stretch of imagination this work is complete. There are many inadequacies and

shortcomings while presenting this subject. Many more Sanskrit and vernacular scholars and researchers in the field of agriculture need to come together for a better and purposeful understanding of the ancient literature to make use of the ancient knowledge. We have many schools, colleges, universities and research institutes devoted to the study of agriculture in our country. The libraries of these institutions should possess the Sanskrit and vernacular texts of their region for the guidance of students and teachers. The subject - *Agriculture in Ancient India* be introduced as a topic under the curriculum of agricultural schools and colleges. I am sure, the scholars will consider this suggestion sympathetically and also look at this volume lovingly.

I take this opportunity to thank all the contributors for their valuable co-operation in bringing out this volume. I shall be failing in my duty if I do not mention the name of Shri S. K. Mutalik without whose help I could not have edited this volume. I am also thankful to Shri Vilas Sangurdekar of Perfect Prints, Thane, for timely printing.

The Institute is highly indebted to the trustees of—

- 1) S. V. Ponshe Educational Trust, Pune,
- 2) Chintaman Charitable Trust, Bombay.

who offered financial assistance towards printing and publishing of the papers presented at the Seminar.

Thane,
15th April, 1993.

DR. V. V. Bedekar
Editor



MINISTER FOR
Agriculture, Horticulture, ~~TEXT~~ and
Employment
GOVERNMENT OF MAHARASHTRA
Mantralaya, Bombay 400 032

22nd April, 1992.

M E S S A G E

I am extremely glad to note that the Institute for Oriental Study is working under your stewardship and protege aiming at Promotion of the Indian Heritage of the yore. The Institute's aims and objects undoubtedly highlight the wisdom of the ancient and glorious past.

There is a need to recognise the secrets of oriental knowledge and philosophy, way of living, usage and custom and agricultural methodology vis-a-vis the modern technology and sophisticated machinery. I am sure that papers submitted in this respect by the esteemed Experts at the Seminar will surely help in throwing light on many of the hidden and unknown aspects of ancient Indian agricultural practices which were more integrated and closely interlinked with nature.

I wish the forthcoming Seminar all success.


(ROHIDAS PATIL)

Dr. V.V. Bedekar,
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Date: 14-05-92

Gentleman,

I have received your letter
dated 30th March, 1992.

I have great pleasure to
hear that you are holding a
Seminar on "Agriculture in Ancient
India". You may send relevant
details and other information on
this subject.

I wish a Seminar great
success.

Yours sincerely,
Shankerji Thakore
(Shankerji Thakore)

Dr. V.V. Bedekar
President,
Institute for Oriental Study,
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Maharashtra.

Agriculture in Ancient India

FIRST ANNOUNCEMENT FOR THE SEMINAR

Dear Sir/Madam,

The topic *Agriculture in Ancient India* has been chosen for this Seminar for two reasons. Firstly, ancient Indian agriculture distinctly differed in its philosophy than the present-day 'agricultural thinking'. Neither its index of success was maximum yield per acre at any cost nor it considered the soil as dead matter. Rotation of crops, perfection of drill plough, concept of commons etc., are as ancient as Indian civilization itself. Secondly, this study of ancient agriculture in our country is going to compel us to find out what was the thought and value system which prevented our ancestors from disturbing the harmony between human beings and environment.

We have voluminous material available on horticulture (*vr̥kṣṣyurveda*) and agriculture (*kṛṣiśāstra*) in Sanskrit literature and other Indian languages.

We are living to-day in a world wherein we have been assured of achievements which were not possible in the past. But do we really know what we want to achieve or have we really understood the achievements of the civilizations of the past? We have dubbed our past as a period of infancy.

All our inquiries and researches are heavily biased in favour of modernity. We have to change radically our thinking to understand our past.

We are talking about green revolution to-day. But very few of us are aware of the price we are going to pay for it. There are more hungry and thirsty people to-day than 10 years before. The success of agriculture of a state or of a few countries is trumpeted out of proportion. Part of the civilization is seen suffering from overeating while many others hardly find anything to eat. Those, who have produced more, to consume more, have created global problems. We, in India are in a haste to follow West to become modern and scientific. This is reflected in our present-day agricultural style. We have practically uprooted our ancient agricultural system. Our farming system has become more and more water-consuming. Our per capita availability of water in 1901 was 9,404 c. meters. In 1941, it came down to 6,972 c. meters, and in 1981 to 3,243 c.meters. If this state of 'progress' continues, in 2001 A.D. the per capita availability of water will be 14% of what it was in 1901.

Science and modernity have become the tools to-day in the hands of socialists & politicians impatient to show miracles. We should protect at least our land and agriculture from this infectious disease.

An unbiased study of agricultural system in Ancient India will show why our ancestors considered a cow so sacred? Why *yajñas* were performed? Why land was equated to the position of 'Mother'? Why plant and animal kingdom formed a part of our divinity? All these need a reassessment to-day.

I am sure, thinkers and scholars of different disciplines would delve deep into our past literature, customs, practices, rituals, festivals, ceremonies etc., and enlighten us on the topic of the Seminar.

For convenience of the presentation of the subject, the theme of the Seminar can be divided into the following topics. The list is only suggestive and not exhaustive.

1. Agriculture in General
2. Agriculture and art
3. Agriculture and Festivals
4. Agriculture, Rituals and Ceremonies
5. Water Management
6. Pest Control
7. Fertilizers
8. Agricultural tools and implements
9. Soil
10. Miscellaneous
11. Bibliography of ancient Indian Agricultural texts
12. Bibliography of modern books on Ancient Indian Agricultural texts.
13. Agriculture as revealed in scriptures, epics, *purānas* and classical literature.
14. Agriculture and Sociology in ancient times
15. Agriculture and Economics in ancient times
16. Agriculture and Seasons with special reference to '*parjanya*'.
17. Agriculture and common grazing grounds.
18. Agriculture and animal husbandry.

I am sure, thinkers and scholars of different disciplines would delve deep in our past literature, customs, practices, rituals, ceremonies etc., and enlighten us on the topic of the Seminar.

Yours faithfully,

Sd/ V. V. Bedekar

Agriculture in Ancient India

FINAL ANNOUNCEMENT FOR THE SEMINAR

The topic of the proposed Seminar is *Agriculture in Ancient India*. The subject is very relevant and needs our immediate attention because of environmental crisis the world is facing today. Today's agricultural system is the reflection of the value system and culture of the modern advanced countries of the West. A closer scrutiny of the whole system has revealed the disastrous effects it has on environment, health and economy of the society.

The much trumpeted scientific successes and technological achievements of this century did increase the world output by 2.6 fold during the year 1950 to 1984. But since then there has been no appreciable increase in the world grain output after 1984. The changes this success is supposed to have brought and the heavy cost we have paid to achieve this success is disastrous environmental damage. Crop lands, forests and grass lands are the three biological systems which support the world economy. The combined area of these three biologically productive categories is shrinking and waste land

and area covered by human settlements including industries are expanding.

We have been measuring our successes now-a-days, whose index is GNP, interest rates and stock prices and other jargon of economics, which is supposed to show our progress story. But very few people understand that it is the change in the biological product that shapes the civilization. It is the changes in the size of the photosynthetic product that ultimately determines how many of us the earth can support and at what level of consumption. The unchecked greed and indiscriminate use of natural resources have led and will lead us to a greater disaster and agriculture is no exception to it.

The present Indian agricultural system is nothing but a blind imitation of the West. The short-sightedness in using modern chemical fertilizers, insecticides, pesticides and water management have given rise to all related problems of the West to us. Very few have known that in Gujrat, over-pumping by irrigators in the coastal districts has caused salt water to invade the aquifer, further contaminating the village drinking water supplies. In Tamil Nadu, for the same reason, water levels have dropped below 25 to 30 metres in a decade. It is the same Tamil Nadu, which still has the age-old 'ery' system which successfully irrigates the fields for cultivation without any damage to surface as well as ground water levels for ages. Alas! modernity has little cared for this ancient irrigation system.

The ancient Indian agricultural system reflects exactly the cultural, religious and social systems of Indian thought process. It distinctly differed from the West in ideology and value system. Land was never a mortgagable commodity in India. It is a gift of the Britishers to us like *Zamindari*. In the joint-family system land never got fragmented. Cow was an inseparable part of the agricultural system, and it was never discarded after its utility was over. But the reformists in India intoxicated by western materialism, consumerism and utilitarian ideology - a part of modern science and progress, converted cow into a beast. Cow was a divinity to ancient Indians and was equally

revered by all the sections of the society and not by the farmers alone. Agriculture was a part of the whole cultural and economic system of the society.

The papers, which are going to be read in the Seminar, will reveal these facts in greater depth and make you richer by the end of the day.

Prof. Shankar Yadav Ponkshe Educational Trust Pune, has instituted an award of Rs. 1,000 to the outstanding research paper presented at the Seminar. The name of the participant, who gets this award, will be announced at the end of the Seminar.

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CONTENTS

Introductory Speech Dr. V. V. Bedekar	1
Indra: The Lord of Agriculture and Bestower of Land P. V. Pathak	13
वेदकाळातील शेतीविषयक कल्पना श्रीपाद के. चितळे	21
Agriculture in the Saṅgam Age Dr. (Mrs.) V. Balambal	26
Agriculture in Ancient India and its Social Aspects Dr. (Mrs.) Radha Krishnamurthy	40
Some of the Agriculture, Forest and Animal Produces in Ancient India Pandit Dr. B. D. Dandavate	56
Agriculture in the Time of Patañjali of Mahābhāṣya Dr. (Mrs.) Kalpakam Sankarnarayan	62
Agricultural Practices Known to Varahamihira Dr. N. Gangadharan	70
Agricultural Myths and Fertility Rituals in Kalidasa's Works M. K. Sridhar	81
Magic in Agriculture Dr. (Smt.) Kala Acharya	95
Glimpses of Kṛṣiparāśara Dr. Ravindra Vaman Ramdas	101

Agriculture as Depicted in Kautiliya Arthaśāstra Mrs. Meenal Paranjape	107
Some Common Agricultral Ceremonies and Rites in Manipuri Life Dr. M. Kirti Singh	116
प्राचीन भारत में मौसम विज्ञान श्रीमती दुर्गा दुबे	122
BhagīrathaVidyā- Irrigation Engineering in Ancient India Jayant R. Ramdas	134
Parjanya -The Mechanical Water Machine- An Exposition Dr. Sudarshan Kumar Sharma	141
Water Exploration in Ancient India G. V. Tagare	155
Fertilizers in Ancient India R. P. Dwivedi	161
Fertilizers in Ancient India Dr. (Mrs.) Rama Bai	166
Women, Forests and Agriculture Smt. S. L. Bhatt	171
पाणिनीये प्रतिफलितं प्राचीन भारतीय कृषिशास्त्रम् डॉ. गं. के. गुर्जर	176
भारतीय शिल्पातील बैलगाडी प्र. रा. अहिराव	181
Appendix -Agricultural Statistics	193

Introductory Speech

Dr. V. V. BEDEKAR
President
Institute for Oriental Study, Thane

President, Delegates and friends,

I heartily welcome you all to this one-day Seminar on *Agriculture in Ancient India* arranged under the auspices of the Institute for Oriental Study, Thane.

When this topic was announced a year back, many eyebrows were raised and doubts expressed—Did anything worth that could stand in comparison with to-day's agricultural advances in all its technology and methodology exist in the past? Or is it an empty boast? You are the best judges today as more than 20 papers—ranging from Vedic times to mediaeval times, exposing the many hidden or concealed expertise in ancient Indian agriculture, will be presented to you. By the end of the day, you will realize that it is not the ignorance about ancient Indian agricultural system prevalent in India, but a kind of resistance due to heavy bias towards modernity, which prevents us to imagine, understand or even appreciate that any achievement of merit by earlier generations of civilization was possible. We take our period of past as a period of infancy and progress as linear growth.

Alas! We are not totally aware of the cost we are paying for our agricultural achievements of today! Our ignorance of modern agricultural system is a matter of greater concern to-day than how much more or little we know about our ancient agricultural system. We talk about the world having come nearer today due to newer systems of communication. All success stories of green and white revolutions are not a global phenomena in the true sense but a success story of a few advanced countries or of a few States in a country or a few districts in a State. Some portion of the civilization is suffering from the hazards of over-eating while a much larger section of the civilization has hardly anything to eat. It is those, who have produced more to consume more, are responsible for the present global ecological problems. We have more than 20 million hungry people in Africa, not due to any natural disaster, but due to man-made destruction of natural resources. Everyday there is some news of shrinking of tropical rain forest. Now Australia and California in the U.S.A., etc., are on the verge of facing a drought. What about our own country and for that matter, our own State of Maharashtra, which is supposed to be one of the most progressive and prosperous States in India? We are reading in the newspapers that Maharashtra is facing drought and there is going to be an acute shortage of water. Are all these things suggestive of any sound progress or achievements over our past agricultural system? The crux of the problem lies in the lifestyle, which we have adopted to suit to scientific achievements, so-called progress and modernity. And in this background, we have to compare the modern and ancient systems of agriculture, and not in terms of per acre output or per capita consumption of wheat or rice or any other such indices, which have no relevance or accountability to our environment and natural resource tapping. Sheer greed to produce more has damaged our environment beyond our imagination, and I am afraid, if we do not realise this in time, we will be facing a situation of irreversible damage to natural resources. Our indiscriminate use of inorganic fertilizers and pesticides to-day will make my point clear. The World Health Organisation (WHO) has shown with adequate supportive data that many of those pesticides used heavily to-day are known to accumulate in

plants, water and living organisms; they are potentially cancer-inducing. They have also shown inducing genetic changes. Many of these chemicals are non-bio-degradable or have a very delayed bio-degradability, which has proved to have adverse impact on our nervous system.

In today's seminar, we have two very interesting papers on the types, nature and system of the use of fertilizers in ancient India. A more detailed study of ancient Indian literature will open the floodgates of information and knowledge on this vital subject and may give us some clues for safer practices of those agents. The highest scientific body in the USA and various other researchers in other parts of the world have proved that organic farming is more productive than the use of inorganic fertilizers and pesticides. But Indians in their haste and trying to become more 'modern' are imitating the West blindly. To-day, in India, there are more than 132 pesticides which have been granted provisional registration under the Act. But out of these only 13 have been fully cleared and scientific data on the effects of pesticides when inhaled by living organisms, are available only in respect of five out of 132.

We are entering into the *Eighth Five Year Plan* and crores of rupees have already been spent in earlier *plans* on irrigation and for provision of clean drinking water. On this front also, the picture is not only grim but frightening. Every passing day brings before us a State or a region joining newly on the map of the country with either water table going down or salinity increasing due to indiscriminate, excessive and uncontrolled attempts to tap water from natural resources.

I will be failing in my duty, if I do not mention here the name of Shri Sunderlal Bahuguna, who is fighting a highly dignified and restrained battle against our deaf and mute planners. His fight to save Himalayan ecology is going to protect future generations from the impending disaster.

We have four papers in today's seminar from water-divining to irrigation system in ancient India. The information presented is just the tip of the iceberg and the subject deserves another fuller seminar exclusively.

The literature available on agriculture in ancient Sanskrit and Prakrit literature is very vast. Apart from specific texts on the science of agriculture which are numerous, one also gets ample information about agricultural systems in the works of grammarians like Panini and Patanjali, from texts of *Silpasastra*, other works like Kautilya's *Arthasastra* and Varahamihira's writings and even in drama and poetry works of writers like Kalidasa. We have more than six papers related to this topic in this seminar. For a fuller justice, one has to sift all ancient Indian literature irrespective of its subject proper it deals with.

For a correct understanding of any Indian system - be it spiritual or material science - a complete knowledge of both the systems is essential. Indian way of looking at human life, human relations, its relations to Nature etc., have a common thread of thought process which binds them all and its appreciation is essential for a study of any one of them independently. Agriculture is no exception to this.

Agriculture was a part of the whole system. A non-agricultural section of the society was equally responsible for agriculture and those who were involved in agricultural operations were equally accountable to the non-agricultural happenings in the society. *Every trade or vocation was important and complementary to each other. The concept of India as a purely agricultural country is also far from truth, and is just a product of modern ideological theory and jargon of economics. All ancient Indian literature and historical evidence goes contrary to this belief and suggests India as a very powerful agricultural as well as commercial and industrial power on the earth prior to the advent of the British.* There are innumerable references to Indian products of all kinds exported to all parts of the world. I quote below a few glaring examples which speak for themselves.

In the early days of the Christian era (1st century A. D. - say about 2000 years before) Roman women's passion for Indian cloth was so intense and powerful that they decorated themselves in seven folds of Indian muslin (called 'Nubula' by the Romans) and paraded in the streets, which brought an embarrassing

situation to the city fathers, and the Roman Senate had to intervene and put an embargo on the import of that fine stuff from India. Pliny, a Roman writer, complained in the early 2nd century A.D. that "... in no year does India drain our empire of less than 550 millions of sesterces", which was approximately equivalent to about pounds 1,400,000 in the 19th century. Another author has noted that in the year of Aurelian, i.e., around the latter half of the third century A.D., this cloth was worth its weight in gold. The Indian exports to Europe of all commercial and agricultural products were much higher at the time of the arrival of the British than in the post-British period. Peter the Great of Russia (1682-1725 A.D.) paid about the commerce of India "as the commerce of the world, and..... he who can exclusively control this is the dictator of Europe." While Indian exports were so high, Europe almost had nothing to sell to India except bullion. The East India Co., which was chartered in 1600 A.D. used to send to India pounds 400,000 to pounds 500,000 a year to buy Indian goods as exports from India before 1757 A.D. It was in 1757 A.D. that the Battle of Plassey was fought and the victorious British started extending their tentacles in India. I quote Sir George Birdwood, who observes - "...the whole world has been ceaselessly pouring its bullion for 3000 years into India to buy products of her industries."

It is said, history repeats itself. The drain of British bullion was so painful and again the Indian textiles, which had become very popular in England, became the victims of enactments for their prevention from entry into England. William III of England in 1700 A.D. prohibited the entry of Indian textiles by imposing a fine of pounds 200 to the wearer or the seller of Indian silk and calico.

As in textiles and in many other basic industrial products, India supplied the best quality of steel then known to Europe. In 1794 A. D. Dr. Scott, M. D., sent to the President of the Royal Society a specimen of wootz steel from India. The sample was put to thorough examination and was analysed by several experts. One such was Mr. Stodart, who qualified the variety of steel from India for fine cutlery and particularly for all edged instruments used for surgical purposes. After

this, that variety of steel was much in demand in Europe and even after 18 years later, Stodart was of the opinion that "... if a better steel if offered to me, I will gladly attend to it; but the steel of India is decidedly the best I have yet met with." These achievements are possible only when there is optimum socio-economic stability in the society. Is this not adequate testimony to suggest that, by and large, the common people of India were living in greater cooperation and harmony, in better and prosperous conditions and had better skills and better earnings as against the perpetrated stories of "thousands of years of atrocities" so near and dear to ideologically committed sociologists, historians, economists and politicians of today? *My point here was just to bring to your notice that in India agriculture was not the sole vocation or industry on which people depended upon but agriculture, trade and commerce prospered simultaneously and not at the cost of each other.*

Now we will see the position of agriculture and irrigation prior to the advent of the British. The position was far more superior and almost all travellers' accounts speak highly of Indian agriculture and the crops. I quote a few observations below.

A Report from British Commission of the North-West Provinces (present Uttar Pradesh) in 1808 says -

"In passing through the Rampore territory, we could not fail to notice the high state of cultivation which it had attained... If the comparison for the same territory be made between the management of the Rohillas and that of our own Government, it is painful to think that the balance of advantage is clearly in favour of the former".

Luke Scrafton, a member of Clive's Council, in his book *Reflections of the Government of Hindustan* (printed in 1770) writes:

"... The manufacturers, commerce and agriculture flourished exceedingly and none felt the hand of oppression... nor is there a part of the world where arts and agriculture have been more cultivated of

which the vast, plenty and variety of manufactures and the merchants were proofs sufficeient."

A traveller in Berar says:

"We experienced very civil and hospitable treatment and found plenty of every kind of grain which this highly cultivated country produced at a very cheap rate."

The picture got radically changed after the Britishers started ruling the country, through their imported system of ownership of land, land tenure, land revenue, laws, education etc.

In the 18th and 19th centuries, in the free countries of the world, the number of people engaged in agriculture was becoming less, while those in industry and service sectors of the economy was increasing. In India, exactly the reverse was happening. There was 'agriculturalisation', of the people with increasing 'deindustrialisation' of the society. The bond of coordination of industry and agriculture in India was destroyed and a new bond of India's agriculture and Britain's industry was established. Destruction of rural and cottage industries, allied trades and commerce ruined all supportive vocations of the bulk of population and the people thus thrown out from their vocations crowded in the agriculture sector. Coupled with new land ownership policy of the British, even the peasants started getting uprooted from land ownership. Land was never a mortgagable commodity in India earlier to British. It was rarely transferable as a matter of right. The laws enacted around 1835 A. D. and in the following years by the British conferred unrestricted rights of transfer of land on occupants of all classes. It could be mortgaged now and could be recovered through the British Law Court. The chief architect of 'Survey Settlement', George Wingate saw this facility as a means of getting rid of uneconomic cultivators and substituting them by pensioners, traders and other parties having capital. This was a turning point in the history of Indian agriculture. In the preBritish India, land had no exchange value and labour was costly. During British rule all those who were deprived of their vocations and trade, flocked to agricultural land and labour became cheap. These things are evident by the repeated famines during the

early British rule in India. This has been endorsed by the Famine Commission appointed in 1878, which says:

“At the root of much of the poverty of the people of India, and the risks to which they are exposed in seasons of scarcity, lies the unfortunate circumstance that agriculture forms almost the sole occupation of the mass of the population, and that no remedy for present evils can be complete which does not include the diversity of occupations through which the surplus population may be drawn from agricultural pursuits and led to find the means of subsistence in manufactures or some such employment...”

These were certainly the crocodile tears as the British themselves were responsible for destroying diversity in occupations which was available to society before their rule.

Another blow to the whole system of agriculture was given by introducing zamindari in India in the British style. In pre-British India the State or the Crown was not the sole owner of the soil unlike in Britain. Even if the king wanted land for his personal use, he had to pay and buy it from the person under whose cultivation it was. Peasants had to pay a fixed share of their produce which was minimal and which was paid normally in kind and occasionally in cash. No agency - *zamindar* or State could ever deprive the peasants of their holdings while in Britain the actual cultivators were mere labourers.

These changes in land policy and revenue system literally shattered the whole system of agriculture and trade in the country. In every territory the British conquered, they tried to raise their revenue through land, irrespective of its potentialities. Poona went in the hands of the British in 1818. In 1817, the revenue was pounds 800,000. In 1818, it was raised to pounds 1,150,000. and after a few more years it rose to pounds 1,500,000. The people were getting poorer and poorer and the rulers were getting richer and richer. But there is not a dearth of people in India who see only divinity in the British people and condemn the Peshwa for petty political gains. Similar is the case with the Punjab, which was annexed

in 1849. In 1847-48 the land revenue in the Punjab was pounds 820,000. Within three years it escalated to pounds 1,060,000.

The case of the Peshwa is very interesting. The year 1800 is considered as the beginning of the downfall of the Peshwa rule. Whatever may be the political situation or circumstance, but at least till the advent of the British, the common man in Peshwa raj had a superior lifestyle and enjoyed prosperity. The social history of people needs a total rewriting with newly available sources. Sir John Malcolm visited the Maratha country around 1803 and his findings are -

“It has not happened to me ever to see countries better cultivated, and more abounding in all produce of the soil, as well as in commercial wealth, than the Southern Maharashtra districts... Poona, the capital of the Peshwah, was very wealthy and a thriving commercial town, and there was as much cultivation in the Deccan as it was possible an arid and unfruitful country would admit.”

This statement of Sir Malcolm is not the only proof of wellbeing of the Poona country agriculturally. But we also have a supportive evidence of prosperity of the people through other sources. Nagpur, in the year 1800, had a very flourishing textile trade. Before the downfall of Peshwa in 1818, the export of cloth woven in Nagpur city and around Pune was of the value between Rs. 1,200,000 to Rs. 1,400,000. Within eight years of British raj i.e., in 1826, it was hardly Rs. 300,000. The agricultural prosperity of Pune people before the advent of the British in turn helped the craftsmen and tradesmen in Nagpur area to prosper. Peter Harhnetty in his paper 'Deindustrialisation' Revisited: The Handloom Weavers of the Central Province of India c. 1800-1947, published in Modern Asian Studies (1991, Great Britain) writes -

“They (*koṣṭhis*) employed Brahmins for their weddings and were not stigmatised as impure, as were most weaving castes. They enjoyed high standard of living and spent lavishly on wedding and other ceremonies...”

He further writes -

“The general population wore coarser cloth woven by Mahars (Dhers) though the best such cloth sold for Rs. 20 a piece. In Nagpur, Dhers spun an extremely fine thread which was then woven by koṣṭhis into dhotis and saris which were the common dress of all classes in Maharashtra.”

This evidence again strengthens the fact that in the pre-British India when vocations were coordinating with each other, people lived in perfect harmony without any caste taboos, while after the advent of the British, due to the British policies, their vocations were destroyed. The people became landless and occupationless and poorer and poorer.

As we study and peep in other subjects and literature for ancient Indian agricultural system, the study of agricultural system in ancient India also gives us in turn newer visions and broader horizons for a better understanding of other branches of science, life and culture in ancient India. What we need is an unbiased, nonmodern, a truly neutral approach to the study of ancient Indian systems. I quote two examples before I conclude. One again is of British times and another of recent times.

Dr. Hove travelled through Konkan, Gujrat and Kathiawar during 1787-88. While passing through Thane, this very town, he has written a very interesting experience as to how the local indigenous experience and knowledge was more useful regarding construction of a sluice. He writes -

“... In consequence, a sluice was proposed, which cost the Company several lacks of rupees. However, as it was begun too late in the season, and finished in the beginning of the rains, so that the combination of the bricks was but slight, and soon demolished by the first freshes, and at last found useless. The engineer who built it, gave it as his opinion, that no sluice could be made sufficiently resistible, or else they would have allowed him double the sum of the former. The expense incident on the former

occasion being already too great, and without the least advantage, the Governor in Council thought it fit to declining, and left it to decay, till a Banian (Baniya) addressed himself to the Governor, with the following proposal. That he would build it up again, and keep it in repair, if they would grant him the plantations for fifteen years free from every tax. The Governor, having given up every thought of receiving any benefit from it, granted him the demand. The Banian, having obtained the permission set on to work in the proper season, and finished it a considerable time before the rains. I had the satisfaction of congratulating him today on his good success, which to my idea he will enjoy, to the infinite censure of the engineer. The rainy season this year was rather severe; however, I could not observe the least damage the sluices have received. I have not seen the Engineer, but must give as my candid opinion that he little understood his profession... The Banian, having obtained permission, made the secret known, by opening four sluices more, which he accomplished with a trivial expense and has every prospect of enjoying it..."

This simple example speaks of the people who had adequate knowledge to support their own agricultural system and irrigation, where theoretical knowledge without experience of the local conditions hardly helped or sometimes lead to disasters.

I quote a very interesting modern example from an authoritative scientific journal 'Nature' (vol.353, October 24,1991)

"US studies on the amount of methane-a potent contributor to the greenhouse effect-produced by Indian cows overstated their threat by a third because they assumed the Indian animals were as large as their US counterparts, a new Indian study finds. Researchers at the Council of Scientific and Industrial Research (CSIR), as part of an exercise to collect data for the 1992 world climate conference in Brazil,

12 / Agriculture in Ancient India

say that US researchers simply extrapolated US bovine measurements made "under very different conditions" from those in India. Indian cows eat and weigh less than US cows. Similarly, methane emission from Indian rice paddies are less than from US paddies of the same size because of smaller biomass of Indian rice plants. Based on world measurements, CSIR estimates that total Indian methane output is just over 10 million tonnes a year-less than a quarter of the 48 million tonnes a year that the US Environmental Protection Agency and Oak Ridge National Laboratory have calculated."

I am sure, Indian systems will have to be studied by avoiding such mathematical and statistical superimpositions of western culture, thought and data, and they people also shall not fall victims in the trap of ideological and political zealots.

I hope today's seminar will be a step in this direction.

I thank you all for honouring the invitation of the Institute to participate in the Seminar.

Dr. V. V. Bedekar

Indra The Lord of Agriculture and Bestower of Land

P. V. PATHAK

1. Introduction:

Indra is the chief deity and supreme god of the Vedic pantheon of gods. He is known to be younger god but has eclipsed the glory of other gods because of his single most important accomplishment of slaying the demon Vṛtra. There are other deeds that Indra performed for his followers. However, killing of Vṛtra dominates the Vedic literature.

1.1 Modern scholars have attempted to understand the nature of the deity. They have identified him to be the thunderstorm god, the sun god, the sky, the storm, the year, raingod and fire. Dandekar has pointed out the human traits and mannerisms of Indra and states that these 'must necessarily be distinguished from the very general human traits attributed to a God as the result of the normal anthropomorphic tendencies¹. According to Holay, Indra represents the celestial point diametrically opposite to the sun. Indra is associated with rainy season².

1.2 There are three main aspects of the event of slaying of Vṛtra by Indra. These being —

- i) Captivation of water by Ahi Vṛtra;
- ii) Slaying of the demon by Indra and;
- iii) Release of the captivated waters by Indra.

Indra is praised by the Vedic seers heartily for slaying of the demon and release of waters.

1.3 Several scholars have attempted to interpret this event. The traditional commentators of the Rgvedic texts like Sāyaṇa, and majority of the modern scholars have taken Vṛtra to be the drought demon holding back waters i.e., a cloud, and slaying by Indra being the act of release of waters from cloud. However, as pointed out by many other scholars, nowhere in the *RV* text the release of waters is associated with rains and hence the event of Indra-Vṛtra conflict cannot be satisfactorily understood. This has also resulted in unsatisfactory explanation of the nature of Indra and is incomplete.

2.1 Vṛtra as an earthen bund:

The author has earlier interpreted the nature of Vṛtra stating that Vṛtra represents the brittle long stretching earthen bund formed due to tectonic upheavals³. This proposition satisfactorily explains the various aspects of the myth. The author has critically reviewed the interpretation of earlier scholars⁴. From the interpretation of Vṛtra as an earthen bund and slaying of Vṛtra being the cleaving of it, the nature of the deity—Indra emerges in a new light. He is not the storm god, or rain god etc. He is the god who released water imprisoned behind an earthen bund.

2.2 *RV* lore on slaying of vṛtra:

There are 93 verses in the *RV* lore which point to all the three aspects of Vṛtra slaying. The water imprisoned by the bund was formed due to tectonic upheaval, akin to earthquake (*Rv* II. 17.5).

The nature of the water imprisoned by demon Vṛtra points to his being an inanimate object. Nowhere in the Rgvedic lore he is supposed to have fought battle against Indra. He lay hidden in water, he grew in water (*Rv* I. 33.11), he

encompassed water (Rv I.52.2). There is an apt description of Vṛtra holding back waters in the dark belly of mountains (Rv I. 54.10) and his ever—growing artificial abodes on the bulging earth. From these R̥gvedic verses and many other it can be seen that the earthen bunds, rather⁵ than clouds, were seen as Vṛtra encompassing waters sustaining life and agriculture.

3. Indra's accomplishments:

It was Indra the only God who killed the demon Vṛtra. According to the Rv lore, other gods like Varuṇa, Parjanya, Apām Napāt, who are associated with water, did not direct their power or mystic powers or forces against the demon Vṛtra. Agni, Soma, Viṣṇu, Sarasvati etc., though praised for killing Vṛtra play a very insignificant role in the episode.

Indra broke open the abodes of Vṛtra and let the river waters take their course to the ocean. (Rv VI. 17.12). The rivers Śutudṛ and Vipāt (i.e., the Sutluj and the Bias in the Punjab) in the famous Vaśvāmītra-Nadī dialogue hymn praise Indra for clearing their paths after killing Vṛtra (Rv III. 33.6). In the flat terrains of the Punjab, obstruction of river waters must have caused great havoc. The incident of clearing of bunds had longlasting effects which are reflected in the frequent mention of Indra slaying Vṛtra.

3.1 Indra accomplished the slaying of Vṛtra very systematically. Slaying of Vṛtra meant cleaving of an earthen bund. Indra is praised for measuring lands, digging channels and letting the water flow at ease. (Rv II. 15.3). He did it like measuring accurately the altars for *yajña* purposes.

*sadmeva prāco vimimāya mānaih
vajreṇa khanya tṛṇandīnām
vīthāsṛjatpathibhirdīrghayāthaiḥ
somasya tā mada indra ścakār RV II. 15.3*

Tr: As if it were an abode of altars (or as a well measured and planned house), Indra measuring with measuring aids dug floodgates (in the bund) into long travelled paths (channels) with the help of Vajra for the rivers to flow at ease. Indra did this when he was invigorated

by *soma* (juice)'.

As the scholars earlier had assumed that Vṛtra was a drought demon holding back the rain waters, this particular verse was not given due attention. One's understanding of Vṛtra as earthen bund makes it pertinent to understand the full significance of this verse.

Indra dug channels by measuring the land (*mimāya*), he used measuring aids (*mānaiḥ*), he opened floodgates (*khānā*), as if it is done while laying the plan of an altar or house (*sadmeva*).

The seer Savya Aṅgīrasa praises Indra for making the land growing tenfold *prithivi daśabhujirahani* (RV.I.52.11) and for having measured the land, *tvam bhuvah pratimānam* Prithivya (Rv. I. 52.13). The motivation for enlarged land is for growing more food for longevity and land measurement is a very basic function in organised agriculture.

These verses are of great importance in understanding the agricultural practices in the Vedic period. It points to the adoption of the canal irrigation system, and wetting of lands. Randhava⁶ refers to the technique practised in the provinces of Sindh and the Punjab still followed by agriculturists. He thinks that even the Harappans must have followed it.

It is likely that Indra and his followers were responsible for devising the technique of irrigation. They laid out paths for accumulated waters and prepared land for cultivation.

3.2 It is Indra who is mainly associated with the agricultural operations in the Vedic literature. He is called as *ūrvarāpati* i.e., Lord of the ploughed land, the fertile fields as well as waste fields. As mentioned in the case of digging of canals, the fields were also measured (Rv I. 110.5). Indra owns many lands and he was active in the wars for acquisition of cattle (Rv V. 33.4). Indra was involved in actual ploughing of the field. He is praised for making the deep furrows as given in Rv IV. 57.7.

Indraḥ sītām ni grhnātu tām pūṣānu yacchtu

Tr: "May Indra press the furrow down, may Pūṣan guide its course a right" (Tr. by Griffith) (Rv IV. 57.7)

Atharvaveda also refers to Indra holding the plough during ploughing operation (Av VI. 30.1).

Rv IV. 57.5 refers to two deities namely Śuna and Sīra. They have been variously interpreted. These deities are associated with agricultural operations. According to Sāyaṇa, Śuna refers to Indra and Sīra refers to Vāyu, both being important for agricultural operations.

4. Meaning of "Gauh" in the Rv.

The Vedic seers very often refer to the conquest of "gauh" by Indra. Following the oldest commentary by Yāska and then Sāyaṇa, most of the scholars have interpreted the word as cows or sun rays. Others like Macdonell interpret it as waters (Macdonell, 1981:59). However these interpretations are not convincing. *Nighantu*, the glossary of synonyms of Rv words lists 'gauh' under the synonym list for the earth (*Nig.* 1.1). In the Purāṇic tradition also, the earth is depicted as cow. With this background, the author has proposed the meaning of *gauh* being earth, or land segments submerged under water due to formation of bund i.e., Vṛtra; with this interpretation, the meaning of the verses become clear and convincing. Interpretation of some of the ṛcs is given below:

- a) "tvaṁ valasya gomataḥ apāvardivah bilam".

Tr: (O, Indra) You have opened the hiding place of vala full of (submerged) lands. Rv I. 11.5.

- b) "a dṛḷham cid arujo gavyamūrvam" III. 32.16.

Tr: '(You have) shattered the firm (demon) hiding the far stretching lands.

Here the word 'gavyam' also means the measure of two *krosas*.

Reference to land measure authenticates the meaning of 'go' being land.

- c) 'mānuṣe gāḥ avindadahannahim" (Rv. IV. 31.13)

Tr: 'Slaying Ahi (Indra) bestowed lands on the human beings'.

There are many other references which refer to 'go' and can be satisfactorily explained by interpreting 'go' as submerged land. In most of the cases it is Indra who is releasing lands.

Association of Indra with the release of submerged lands points to his being deity of agriculture and bestower of lands.

5. References in the *Sūtra* literature :

The *Sūtra* literature is of a later period. The various *Sūtras* deal with ritualistic performances. In these *Sūtras* also, the deity Indra is associated with the annual sacrifices performed by agriculturists, *Pāraskargṛhyasūtra* refers to Indrapatni as *Sītā* i. e., cultivable land (*Pgs* II 17.9). The particular ritual performance is known to be *sītāyajña* (*Pgs* II.17) i.e., furrow sacrifice. During the *Navaprāsana* ritual i.e., harvesting time, Indra is referred to as Lord of the plough (*Īndra āsīt sīrāpatih*). In addition to this, the *Śunāsīrīya* festival from the *Śrauta Sūtras* similarly point to Indra's association with the agricultural rituals. (*Apss* VIII. 20, *Apss* I.20, *Apss* III. 18, XIV. 19). The nature of *daṣṣiṇā* is of twelve bullocks.

6. The Nature of Deity Indra :

It can be seen from the discussion above that Vedic deity Indra cannot be seen as manifestation of thunderstorm, the sun etc., as done by the earlier scholars. The following points emerge when Indra's accomplishments are seen in the light of tectonic upheavals and *Vṛtra* being an earthen bund formed due to tectonic upheavals.

1. Indra was responsible for slaying of *Vṛtra* i.e., cleaving of earthen bunds and release of waters captivated behind the bund.
2. While releasing waters, he laid out the paths (channels) for the released waters as if they were well measured. This points to canal irrigation practices adopted by Indra and his followers.
3. Indra is known as Lord of lands, the *Ūrvarāpatih*, also as *Śuna*— the deity of agriculture. He furrows the lands; the deep furrowed lands are blessed by him. He also holds a plough.

4. Indra's accomplishments of releasing 'gauhi' can be better understood by taking meaning of the word as cultivable-irrigated lands. Indra released the lands submerged under water held captive by the demon Vṛtra i.e., earthen bund.
5. Indra's association with the rituals performed annually by agriculturists is referred to extensively in the *sūtra* literature.

Conclusion:

The Vedic deity Indra is, therefore, the 'Lord of Agriculture' and 'Bestower of lands' and was associated with irrigated land cultivation practices in the Vedic period.

References

Short Forms Used:

RV.	:	<i>R̥gveda</i>
AV.	:	<i>Atharva Veda.</i>
APSS.	:	<i>Āpastamba Śrauta Sūtra.</i>
ASSS.	:	<i>Āśvalāyana Śrauta Sūtra.</i>
PGS.	:	<i>Pāraskar Gṛhya Sūtra.</i>
SSS.	:	<i>Sāṅkhyayana Śrauta Sūtra.</i>

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20 / Agriculture in Ancient India

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वेदकाळातील शेतीविषयक कल्पना

श्रीपाद के. चितळे

विज्ञानाच्या शिक्षणाने अभ्यासकाला, या जड जगात काय काय रहस्य आहेत हे जाणून घेण्यासाठी एक आवश्यक, चिकित्सक, व अद्ययावत् संशोधन क्षेत्रात वैज्ञानिक तर्क कसोटीवर घासून घेण्याची दृष्टी मिळते ह्या मताचा मी आहे. जे दिसते तेच खरे, पण वैज्ञानिक दृष्ट्या व जे दिसत नाही, ते मिथ्या असा मात्र याचा अर्थ नव्हे. कारण ज्याने दुर्बीणीय खगोलशास्त्राचा (Telescopic Astronomy) सखोल अभ्यास केलेला आहे, त्याला आपल्या ह्या ग्रहाची म्हणजेच ब्रह्माण्डात पृथ्वीची नगण्यता, तिची अस्तित्वशून्यता निश्चीतपणे पण वैज्ञानिक सत्यावर ज्ञात झालेली असते. तरीपण विज्ञानाचा तिसरा डोळा त्याच्या जवळ असतो. पण अध्यात्माचा चौथा डोळा असणारा साधक अक्षरशः लाखात एखादाच. विरळा ! ह्या वैज्ञानिक दृष्टीचा मी पक्का पुरस्कर्ता असल्याने अगदी वेदवाङ्मयाचा ही गेल्या ५-६ वर्षांपासून अभ्यास करीत आहे. ह्याच अभ्यासातून वैदिक काळात (कालखंड थोडा फार मागे-पुढे) शेती विषयक काय कल्पना होत्या हे मी प्रस्तुत लेखात मांडणार आहे, ते ही एक नम्र व चिकित्सक अभ्यासक म्हणून.

वेद इतके प्राचीन आहेत की हमखासपणे वेदांशी समकालीन वा त्याहूनही प्राचीन म्हणता येईल असे वाङ्मय वा अवशेष आज तरी उपलब्ध नाहीत. वेद वाङ्मयातील संहिता निरनिराळ्या ऋषींनी रचल्या असून त्या वाङ्मयात भौतिक अभ्युदय व निश्रेयस-शाश्वत कल्याण ही मानवी जीवनाची प्रमुख उद्दिष्ट्ये ही त्यात प्रतिबिंबित

दिसतात. पण प्रस्तुत लेखात आपल्याला त्या वाङ्मयातून शेतीविषयक कल्पनाचे काय संदर्भ मिळतात हे पहावयाचे आहे.

शेतीची कल्पना किंवा तत्संबंधी झालेली क्रांतिकारी बदल हा नवाश्मयुगातील (Neolithic) मानवात प्रामुख्याने दिसून येतो. साधारण हा काळ इ. स. पूर्व २५०० ते १००० असा येतो. अर्थातच वैदिक संस्कृतीचा काळ अनेक पुराणांच्या आधारे विचार करता इ. स. पूर्व १५०० ते १००० सरासरी असा येतो. या काळासंबंधी मात्र आता बरेच सखोल संशोधन झालेले आहे. पण आपला आता तो विषय नाही. या नवाश्मयुगीन काळात मानव प्रथम शेती करू लागला. त्यामुळे स्वाभाविक त्याला एके ठिकाणी घर बांधून रहावे लागले व अशा रितीने त्याच्या गतिमान व भटक्या जीवनाला स्थैर्य प्राप्त झाले. पिकविलेले धान्य साठविण्यासाठी तो मातीची भांडी तयार करू लागला व शेतीला पोषक व आवश्यक असे पशुपालनासही त्याने सुरुवात केली. ह्या क्रांतिकारक बदलामुळे निरनिराळ्या हत्यांराचीही गरज त्याला भासली.

मात्र वैदिक कालखंडातील शेतीविषयक कल्पनांना वाङ्मयी पुराव्यांचाच आधार आहे. नेमकी ही गोष्ट वैदिककालीन असे सांगणे कठीण आहे. वैदिकवाङ्मयात भौतिक अभ्युदयाचे अनेक उल्लेख आढळतात. जसे लढाया, अवकाशात कडकडणारी वीज-वायु-भूमि जल व आकाश ह्या तत्त्वाविषयी काही संकल्पना, मानवी जीवनपद्धति, वेशभूषा, केशभूषा, पोषाख, आहारविहार, विवाहविषयक कल्पना, शेतीविषयक ज्ञान, निसर्गातील काही चमत्कार, पर्जन्य, विजांचा कडकडाट व लखलखाट, धान्य, पशुविषयक ज्ञान, नद्या, पर्वत, सूर्य, चंद्र, वातावरण, भूगोल, सुरापान, लोकरीचे कपडे, काही व्यावसायिक श्रेण्या — जसे लोहार, सुतार, चांभार, धातुविषयक ज्ञान, नौकायन रथ, बैलगाडी, हूत, रथ स्पर्धा, नृत्य आदि मनोरंजनात्मक साधने असे विविधांगी ज्ञान वेदवाङ्मयात आहे व त्यातूनच तत्कालीन समाज जीवनाचे सर्वांगीण चित्र आपल्या समोर येते.

ऋग्वेदाच्या ४ थ्या मंडलातील सत्तावनावे सूक्त हे केवळ ऋषियुक्त असून १०व्या मंडलातील ३४वे सूक्तातील १३वी ऋचेत 'शेतीत आणि संपत्तीत तू रममाण हो' असा उपदेश कवष-एलूष ऋषींनी केलेला आहे. संपूर्ण वेदवाङ्मयात सुमारे २५०-३०० ठिकाणी शेती विषयक उल्लेख आलेले आहे. पण आपण त्यातील महत्त्वाचे व शुद्ध संदर्भाचे अवलोकन करू या!

खालील उल्लेख पहा -

अक्षैर्मा दीव्यः कृषिमित कृषस्व वित्ते रमस्व बहु मन्युमानः।

तत्र गावः कितव तत्र जाया तन्मे वि चष्टे सवितायमर्षः॥

अर्थ - 'फाशांनी जुगार खेळू नको, तर शेती कर आणि संपत्तीमध्ये रममाण हो, म्हणजे तू मान्यतेला चढशील. शेतीत गाई मिळतील आणि बायकोही मिळून तुझा संसार सुखाचा होईल. ही गुप्त गोष्ट मला प्रत्यक्ष सूर्यनारायणाने सांगितली व अनुभवास आणून दिली.'

ह्यामध्ये शेतीला मानवी जीवनात प्राधान्य देवून त्यातून ऐहिक जीवनाची उपभोग्यताही दर्शविली आहे.

शुनं नः फाल वि कृषन्तु भूमि, सुनं कीनाशा अभि यन्तु वाहैः
शुनं पर्जन्यो मधुना पयोभिः शनासीरा शुनस्मासु धत्तम ॥

ऋ ४-५७-८

अर्थ - 'फाळ आम्हासाठी सुखाने नांगरो. शेतकरी बैलासह सुखाने जावोत. पर्जन्य सुखाने मधुर उदकांचा वर्षाव करो. हे शुनासिरांनो तुम्ही आम्हाला सुख द्या.'

शेत नांगरतांना ह्या सूक्ताचा जप करावा. क्षेत्रपती म्हणजे शेतकरी. हे संपूर्ण सूक्त व त्यातील ८ ही ऋचा शेतीसंबंधी आहेत. त्यात नांगर, पर्जन्य, शेतकरी, बैल, फाळ, लाकडाचा किंवा लोंखडाचा, आदि उल्लेख आहेत.

सुनक्त सीरा वि युगा तनुध्वं कृते यौनो वपतेह बीजम् ।
गिरा व श्रृष्टीः सभरा असन्नो नेदीय इत्सुव्यः पक्कमेयात् ॥

ऋ. १०-१०१-३

अर्थ - 'हे मित्र हो, औते जोडा, पाळ्या पाडा आणि पाळीत बी पेर. आमच्या प्रार्थनेमुळे पीक चांगले येईल. लवकर आलेल्या पिकावर विळाही चालू लागेल.'

याच सूक्तात ५व्या ऋचेत 'वरत्र' असा शब्द येतो त्याचा अर्थ मोट असा असून तिचा शिवण्याचाही म्हणजे मोट तयार करण्याचाही उल्लेख आढळतो. अर्थववेदातील ३-१७-२ अशाच मंत्राचा एक उल्लेख पहा -

युनक्त सीरा वि युगा तनोत । कृते योनौ वपतेह बीजम्

केवळ 'तनुध्वं' च्या ऐवजी 'तनोत' हे शब्द उत्तरकालीन आहे. अर्थ तसाच आहे.

ऋ. ४-५७-४ नांगराचा स्पष्ट उल्लेख पहा. शनूं कृषतु लाङ्गम्. लाङ्गल म्हणजे नांगर असाच उल्लेख अथर्ववेदात जमीनीची सेवा करावी व शेतकऱ्यांनी क्षेत्रपती मोठ्या प्रेमाने गोंजारून बैलाच्या पाठीमागून जावे असे स्पष्ट म्हंटले आहे. 'बैल व मी म्हणजे जणू रथाची २ चाकेच होत' असाही उल्लेख केलेला आहे.

सीरा (ऋ. ४-५७-५ व ८) (१०-१०१-३ व ४) अथर्ववेद ३-१७-१, २, ५, ६वा. लाङ्गलम् हे २ शब्द वेदसंहितेत वापरले आहेत. 'सीता' याचा अर्थ नांगरलेली जमीन असा होतो. पूर्व मशागतीनंतर बीजधारणेसाठी जमीन तयार करण्यासाठी सन्या वाफे किंवा आळे तयार करण्यासंबंधीचे उल्लेख ऋ. १०-१०१-३ व अथर्व. ३-१७-२ यात आहेत. वरील ऋचात पूर्वार्धात 'युनक्त सीरा वि युगा तनुध्वे' यामध्ये नांगर जोडण्याचा व जू नीट ठेवण्याचा निर्देश आहे. योनी या शब्दाचा सायणार्थ 'बीजधारणेसाठी तयार केलेली सरी- आळे, वाफे वा पाळी' असा करणेच श्रेयस्कर व योग्य आहे. विद्यानिधि चित्राव शास्त्री 'योनि' चा अर्थ पाळी असा घेतात तर म. म. बाळशास्त्री हरदास देखील तोच अर्थ योग्य असल्याचे सांगतात. 'योनि' चा अर्थ नांगरणीची विमुक्त रेषा असा करतात. थोडक्यात, वेदकाली पेरणीसाठी जमीन तयार करणे या प्रकाराचीही माहिती या ऋचाचे द्रष्टे ऋषि बुध-सौम्य व विश्वामित्र यांना होती असे मानावेच लागते. आंतरमशागत देखील पीकांच्या उघड्या पादपांना [मुळांना-पायाने पाणी पिणारे पादप] मातीचे आवरण घालणे, पाणी व त्याचा निचरा, भुसभुशीत पोत राखण्यासाठी किंचित प्रमाणात रेती मिसळणे आदी सर्व प्रकार वैदिकांना ज्ञात होते.

वेदवाङ्मयात नांगर, नांगराचा फाळ, जुंपणी, चाबूक, सूप, विळा इत्यादि शेती अवजारांचा व उपकरणांचा उल्लेख येतो तर नांगर कसा तयार करावा ह्यासंबंधीचे वर्णन अथर्ववेदात आहे. कांड ३ सूक्त १७, मंत्र ३ मध्ये पुढील माहिती आलेली आहे.

लाङ्गलम् पवी खत्सुशीमं सोमसत्सरु । उदिद्वपतु गावविं प्रस्थावद्रथे वाहंनं
पीबरोच प्रफर्व्यङ्म ॥

नांगर तयार करतांना लोखंडाचे दृढ व तिक्ष्ण धारेचे फाळ लावा आणि हातात धरण्यासाठी लाकडाची मुठ रुमणे तयार करा.

या नांगराची सुलभता व उपयुक्तता आजही शास्त्रज्ञांना मान्य आहे. Indian Council of Agricultural Research, New Delhi यांनी *Hand Book of Agriculture* या पुस्तकात भारतीय नांगरासंबंधी असे म्हटले आहे, "It can thus be seen that the *desi*plough is a multipurpose implement difficult to be replaced unless more efficient multipurpose improved implements are designed."

अथर्ववेदात तृतीय काण्डात १७व्या सूक्तात धनधान्यांने जन समृद्ध व्हावे म्हणून शेती करण्याचा उपदेश आहे. या सूक्ताचा द्रष्टा विश्वामित्र ऋषि असून त्यात पृथ्वीला त्यांनी देवतास्वरूप मानून तिची स्तुती केली आहे. 'पृथ्वीस मातृस्थानी मानणारे सूज

जनानो, समृद्ध व्हावे म्हणून नांगर सिद्ध करून योग्य ठिकाणी जू बांधून शेती करण्यास्तव सिद्ध होतात तसेच लोकहो, नांगर वगैरे तयार करा, जमीन खूप व्यवस्थित व खोल नांगरून बीजाधारणेसाठी जमीनीत सऱ्या [ridges & furrows 'योनि'] पाडा नंतर त्या सऱ्यात 'योनी' बीजाची पेरणी करा. त्यामुळे शेती खूप पिकून भरघोस पीक पदरात पडेल व तुम्ही समृद्धि मार्गात रममाण व्हाल' हा शेतीचा, भौतिक समृद्धीचा भौतिक अभ्युदयच होता असे कोण म्हणणार नाही. सिंधुसंस्कृतितही शेतीसंबंधी (इ.स.पूर्व ४००० वर्ष) खूप पुरावे मिळतात. तसेच वेदकालीन शेती म्हणजे ख्रिस्त पूर्व ४५०० ते २५०० वर्षे या कालखंडात वेदकालीन कृषि व कृषिजीवन या संबंधीची माहिती प्रामुख्याने ऋग्वेद मंडल ४, मंडल ७, सूक्त ३५ व ४९, तसेच मंडल १० सूक्ते ३४, ४८, ७९, ६८, १०१ या मंत्रात व अथर्ववेदात काण्ड ३ सूक्त १७, व ४-११ यातून मिळते. आर्यांची (सभ्यसुसंस्कृत ह्या अर्थी हा शब्द आहे.) उपजीवीका प्रामुख्याने शेतीवरच होती. यावरून शेत नांगरणारा व आर्य यांचे किती घनिष्ठ संबंध होते ह्यांचे सहज आकलन होईल. आजच्या प्रगत कृषि शेतीची बीजे वेदकालीन शेतीत दिसून येते. जमीनीचा पोत, कसणुक, पूर्व मशागत, आंतरमशागत या सर्व बाबीत वेदकाळात शेती तसेच योग्य वातावरणाकडेही ते लक्ष देत. एके ठिकाणी पर्जन्याचे पाणी वाहवून न जाता कुठे तरी संकलित केल्यास त्याचा उपयोग पुढे करून घेता येईल असा उल्लेख येतो. त्यातूनच कालव्यांची कल्पना विकसित झाली असावी. ह्या सर्व संदर्भावरून स्पष्ट दिसते की, वेदकालीन शेती ही खूप जरी प्रगत नसली तरी शेतीविषयक तत्कालीन जगापेक्षा वैदिकांना त्या क्षेत्रातील ज्ञान, अनुभव व तर्कावा सापेक्षत्व अधिकच होते.

संदर्भ

- १) ऋग्वेदाचे भाषांतर विद्यानिधि चित्राव-श्रुतीबोधकार पटवर्धन
- २) डॉ. म. त्र्यं सहस्रबुद्धे (अवकाशप्राप्तसंस्कृत प्राध्यापक, नागपूर विद्यापीठ, नागपूर) यांचे प्रत्यक्ष वार्तालाप
- ३) *Hand book of Agriculture* -I. C. A. R. New Delhi.
- ४) श्री. स. ज. कोडोलीकर-वेदकालीन शेती मिरज
- ५) श्रीनाथ बिस्सा अभिनंदन ग्रंथ - बिकानेर- राजस्थान
- ६) वैदिक विज्ञान—आधुनिक विज्ञान १,२,३, संशोधन लेख विदर्भ डॉ. म. त्र्यं सहस्रबुद्धे, श्री. के. चितळे, संशोधन मंडळ वार्षिक ८९-९०

Agriculture In The Sangam Age

Dr. V. BALAMBAL

Introduction :

The primitive man depended on his might for survival. Later, when he had developed a social sense, he slowly attended to hunting, cattle-rearing and finally to agriculture. His social behaviour and economic activities changed when he had a settled life in course of time. The plains and river valleys became centres of economic activities. When population grew, there was need for more production and marketing. So man had to think about various devices for increasing production.

In the ancient Tamil society (i. e.) Saṅgam society, men lived in five-fold divisions of land. (i. e.) *Kuriñchi* (hilly tracts), *Mullai* (pastoral lands), *Marudam* (agricultural lands), *Neidl* (coastal lands), and *Pālai* (dry lands). According to the nature of the land, the occupation of the people differed. The pastoral economy led to the simultaneous adoption of cultivation of arable land wherever possible.

During Saṅgam age and even afterwards, agriculture was the main vocation of the Tamils. As it was considered basic to all other occupations, it was treated as the foremost and the most important of all the occupations. The high place of agriculture in the economy of the country and the phenomenal fertility of the soil in the river basins are clearly reflected

in the Saṅgam literature which forms the main source to the present study. *Tolkāppiaṁ*, the earliest Tamil work gives importance to agriculture. *Pattuppāttu* (Ten Idylls), *Eṭṭuttogai* (Eight Anthologies), *Silappadikāram* and eighteen minor works form the primary source material to prepare this paper on various aspects of Saṅgam agriculture. The Saṅgam age which stretched up to 3rd century AD witnessed development in agriculture. As it was a long period, agriculture in the earlier stages of Saṅgam period would have seen primitive methods, and in course of time, man would have improved in the techniques of ploughing, irrigation, weeding, manuring, harvesting, storing and distribution. Slowly the tribal economy gave way to rural economy.

Classification of Cultivable Lands

Marudaṁ land was fit for cultivation as most of the lands were fertile. Iṅgō Adigaḷ, the author of *Silappadikāram* begins the epic by hailing the three natural resources i.e., sun, rain, and earth, which are the basic requirements for cultivation. The prosperity of a farmer depends on necessary sunlight, seasonal rains and the fertility of the soil. Sunlight could not be substituted with any other thing. But if rain fails, other methods of irrigating the soil could be possible; similarly, though the naturally fertile land would yield more, in the absence of fertility, artificial manuring would enrich the soil. The ancient Tamils were well aware of these and they differentiated the lands on the basis of fertility and accordingly produced the respective crops.

Puranānūru gives a beautiful classification of lands according to fertility. They were *Vaṅpulaṁ* (hard land), *meṅpulaṁ* (fertile land), *piṅpulaṁ* (dry land), and *Kaḷamilam* or *Uvarṇilam* (salty land).¹ *Vaṅpulaṁ*, in *Mullai* and *Kuriñchi* did not yield rich produce whereas in *meṅpulaṁ*, due to fertility of the soil and good water supply, the yield was very good. *Piṅpulaṁ* had less irrigational facilities and dry crops were produced. The *Kaḷamilam*, the salty land was unfit for cultivation.

The alluvial soil, red soil, black soil, laterite soil and sandy soil were seen in different parts of the Tamil country and

the Tamils knew what crops were to be grown in each type of land.

Signification of Agriculture

The chief occupation of the Tamils has been agriculture which is an esteemed profession.² Though there are many occupations, all must depend finally on farmers.³ Removal of weeds and reclamation of lands for purposes of agriculture constitute a landmark in the progress of civilization. Kings reclaimed forest and hilly lands. In earlier stages, paddy was cultivated on the slopes of hills after clearing the thorns and bushes. The farmers were the nucleus around whom everyone revolved. They were the linchpin and sheet anchor of the world. As he is the cultivator, the peasant lives with self respect, but all other occupationists have to bow down before their superiors. Even the ascetics will become helpless if the farmers do not cultivate the soil.⁴ If an owner of the land fails to attend to his land, he would lose his right over the same.⁵ The greatest wealth one possesses is his land. If he fails to realise it, he would become a laughing stock.⁶

Hence agriculture is esteemed as the main occupation of the people. When there is decrease in production, it leads to deterioration of living standard too.⁷ Once, the Sangam was temporarily dissolved because of twelve years of continuous famine in the Pandyan Kingdom.⁸ Sometimes the condition became so bad that the peasants had to consume the seeds normally intended for sowing. Hence the ruler of the land and owner of the soil had to plan their economy and produce more corn and store it for times of need. It was the primary duty of the king to see that his people got the basic necessities to improve food production.

Agriculturists and Land Ownership

Though it was not clearly stated that the king was the owner of all lands, it could be taken that the king also owned lands as he had donated lands to poets, Brahmins, schools, hospitals etc. Moreover, peasants and landlords paid land tax to the king as he administered the kingdom and protected his people. The bulk of the agriculturists were cultivators of their own plots of land. They were the tillers (*uzhavar*)⁹ of the soil.

They were also known as *Uḷutunbār*¹⁰ or *Yēriṇvvalṇar* because they subsidised through the end of the plough or *Vellālar* (proprietors of water) or *Kāraḷar* (rular of clouds) of *Kaḷamar*.¹¹ Women agriculturists were called *Uḷathiar*.¹² High and low class *vellalas* mentioned in *Tolkāppiam* are those who maintained themselves by causing land to be ploughed and as those who maintained themselves ploughing the land, respectively. The former, besides holding land, held high offices under the king, discharging civil and military duties, assumed titles of *Vel*, *Arasu*, *Kāvidi* and had matrimonial alliances too with the royal family.¹³

Apart from the traditional landlords and cultivators, there were absentee landlords too. When lands were gifted with labourers to Brahmins, poets etc., these donees in turn left donated lands in the hands of the tenants or farm labourers.¹⁴ The terms of tenancy in respect of such cultivation in not known. Valluvar says that an active and independent farmer could produce more¹⁵ and he has to guard himself against absentee landlordism.¹⁶ The labourers employed in the lands were different from slaves.¹⁷ Of course, the slaves of the Sangam age cannot be compared to that of their counterparts in Greece or Rome where they suffered and slogged. Sometimes, independent labourers were engaged for specific purposes. They were known as *adiyor*.¹⁸

Hence from great landlords, who owned vast stretches of land, to an ordinary cultivator, who owned a tiny piece of land, the feeling that they were owners of land, producers of food etc., was there. Though their financial status had resulted in commanding respect in their areas, every cultivator was respected.

Produce

The ancient Tamils cultivated varieties of paddy, sugarcane, millets, pepper, sandalwood, various grams, coconuts, beans, cotton, plantain, tamarind etc. The peasants lived under the shady groves beyond the *Marudam* land. Each house had jack, coconut, palm, areca and plantain trees. Turmeric plants were grown in front of the houses and flower gardens were laid in between the houses. If not with the modern facilities the ancient Tamils lived in houses located in healthy, hygienic and

airy environment. Cultivation of fruit trees and crops for cattle was undertaken by Mullai people. Those who produced sugarcane employed even mechanical contrivances to extract juice from it.¹⁹ In some plots rotation of crops was followed. Cotton and millets were grown simultaneously on the same plot and after these, beans were cultivated on the same land.²⁰

Paddy was the main crop and different varieties of paddy such as *Vēṇṇel*, *Sennel*, *Pudunel*, *aivaṇṇel*, *tōrai*, were grown in the wet land of *Marudam*.²¹ *Sennel* and *Pudunel* were more refined varieties. In a very fertile land, a *Vēli* of land yielded 1,000 *Kalams* of paddy.²²

Even without ploughing, merely sowing deep in turned sod made mustard grow in great quantities.²³

The Tamil country produced many varieties of crops in plenty. Each village was almost self-sufficient and if necessary the people were buying the needed commodities from the neighbouring villages. Mostly barter system prevailed and paddy and salt were used as medium for buying and selling. As workers and soldiers were paid in kind i.e., grains, there was need for growing more crops. The king also had to depend on production as he had to pay his soldiers and officials. This also accelerated the cultivation.

Methods of Cultivation

The ancient Tamils were very systematic in cultivation. Though many were illiterate, their experience in the soil and love for their land made them dedicate themselves to it. Paddy field was known as *Kaḷam*.²⁴ Oxen²⁵ and plough²⁶ were used for ploughing.²⁷ Ploughshare fixed to a yoke was drawn by bulls or buffaloes. *Tirukkural* gives a detailed account of agricultural activities. If the five steps i.e., ploughing, fertilization, weed control, irrigation and crop protection are followed in a proper manner, the land would yield richly.²⁸ Wider and deeper ploughing would enrich the field. If the land is well ploughed, there is no need for manuring even. At the same time Valluvar says that more than ploughing, manuring is essential. Both deeper ploughing and fertilization would yield a better crop. When the plants grow, if weeds are allowed to grow, the crop would fail. Hence, it is absolutely essential to remove the weeds. Irrigation is the backbone of agriculture. Valluvar

states that more than irrigation, the crops are to be well protected. Young girls were kept to watch and protect the crop from birds and stray animals. If we analyse the chapter on agriculture²⁹ it is clear that Valluvar gives importance to each step to be followed in cultivating land to get an excellent yield.

Perumpanarrupadai narrates interestingly the agricultural activities of the ancient Tamils. Land was ploughed with the help of oxen,³⁰ ploughed lands were levelled by the peasants using their legs; then they planted the paddy seeds and after their growth, they were transplanted³¹ and weeds were removed by both men and women with wooden implements.³² When the crops grew fully, harvesting took place.³³ Paddy stalks were stored in a place where paddy was removed from the stalks by beating them on the ground or by making the bullocks tread on them.³⁴ Cleared paddy was collected, measured and stored in proper places.

Though the Sangam agriculturists did not know the use of tractors, or the Japanese method of cultivation, or the chemical fertilizers etc., with their rich experience and knowledge, the illiterate peasants were producing double or treble the quantity of crop in the same plot of land and Tamil country has been described as a land of milk and honey, meaning prosperity.

Milletts were grown in dry lands and *Kuriñchi*.³⁵ The *Kuravan* and *kurathi* took pains to drive away the elephants and birds with the help of *kavan* (stone-sling).

The accurate throw of the stone would even cause death. When the birds or animals tried to eat the tender beans, they were driven out of the field.³⁶ The role of young girls in protecting the crops from stray animals and birds was commendable.

Irrigation

In the earlier stages, though agriculture depended on rain and river waters, the growth of population led to better and more methods of irrigation. Almost all types of irrigating lands in existence at present, have come down from the early times.

As South Indian rivers are not perennial rivers, procuring adequate and regular supply of water for cultivation has been

the greatest problem of the Tamil country, which is essentially an agricultural region. Apart from rivers, tanks, lakes, falls and dams were important sources of water supply for irrigating lands in the Sangam age too. Sluices and shutters were constructed for regulating water for irrigation.³⁷ Some times buckets made of reeds were used for watering the lands.³⁸ In order to control the water flooding the rivers, sand mounds were raised so that water could be diverted for irrigation.³⁹ Direct irrigation from canals was possible in the Kaveri, the Periyar and the Tambraparni basins. King Karikala Chola of the Sangam age is said to have raised bunds and constructed a dam on the Kaveri which is considered to be one of the earliest dams in the country. The Kaveri, the Pennai, the Palaru, the Vaigai and the Tambraparni spread their fertilising waters on these fields of 'golden harvests'.

Rain water was the natural source for irrigation and the peasants started ploughing only after heavy rains.⁴⁰ Valluvar insists that rain is absolutely essential for the prosperity of man and the crops.⁴¹ *Puranānūru* emphasises on the importance of rains before sowing and how easy it is to sow in the rain-fed field.⁴²

Valluvar also says that for the survival of mankind and crops, rain is absolutely essential.⁴³ Though Valluvar felt that if there was no rain, there would not be any work for a farmer,⁴⁴ has proved incorrect in some cases as we have come to know the use of well, lake, pond and canal irrigation to fields.

Water stored in tanks and reservoirs was utilised for irrigation. Small channels connected the reservoirs with the fields of cultivation.⁴⁵ Ancient Tamils were well aware of the means of averting havocs during floods. Canals were used to water the lands.⁴⁶ Rain water was utilised to irrigate lands.⁴⁷ Lakes were also an important source of water supply.⁴⁸ Uruttirankannanar says about king Karikala digging lakes for irrigation.⁴⁹ Men and oxen were used for drawing water and irrigating the lands.⁵⁰ Common device was the use of the run off from the streams and rivers as well as the underground water which was lifted and reached to the lands. There is a considerable amount of spring channel irrigation in the Palar,

the Kaveri and the Vaigai beds. So to raise a second crop, well water is useful. People of the age knew how to divine the spots where there was flow of water and sink wells.⁵¹

The ancient Tamils were well trained in watering the lands in very many ways. When water was available and lands were numerous, it became the duty of the village authorities to distribute the available water in a proper way. Hence the local authorities appointed day and night watchmen to guard the tanks and reservoirs and regulated water supply.⁵²

To avoid the wastage of water, surface irrigation, sprinkler irrigation and drip irrigation methods were followed.

Three methods were followed in irrigating the lands; (a) for rop standing in a row, water would be lifted from the pond and poured into the land. (b) Water was drawn with the help of oxen and diverted into the cultivable land. (c) Water lifts (*Erram*) were used for drawing water.⁵³

Implements

For cultivation an agriculturist needs various implements. With the available raw materials, the ancient Tamils prepared various implements which were necessary at each step of agricultural activity i.e., from the day the land was to be ploughed till the harvest was over. The basic requirement was a plough⁵⁴ also known as *mēzhi*, *nañchil* and *kalappai*.⁵⁵ It comprises of a wooden piece to tie the oxen and iron implement to plough the land. The plough looked like the cut off portion of an elephant's mouth and trunk.⁵⁶ The ploughing was to be in such a way that low lying sand would be brought to the upper layer and top land would go to the bottom to make sand airy and fit for sowing.

For digging the earth, a wooden handle with sharp terminal like spade was used.⁵⁷ A wooden leveller known as *palli* or *maram* was used for levelling the ploughed land. *Palliyādutal* refers to the removal of weeds by means of a toothed implement attached to a plank which was drawn by oxen.

The farmers used a bullock-drawn contrivance called *Kapilai* for baling out water from deep wells and operated a contrivance called *ēṟṟam*⁵⁸ for shallow wells. Water bales were also known

as *ampi* and *Kilar*. To safeguard the crops in the fields, stone slings (*Kavan*)⁵⁹ were used to drive the birds and animals away; *tallai*, a rattling instrument to annoy the animals⁶⁰ was used.

Bugles and burning torches for scaring away the animals and stones for driving away the elephants were used by the Tamils.⁶¹ The simpler methods were clapping the palms and thumping the feet. The costliest method to drive the birds away is narrated in the Sangam literature. The girls in the field threw their golden earrings as stones on the birds! Whether gold was so cheap or whether the women agriculturists were so much rich is yet to be known. To frighten the wild beasts, they lit flames of fire.⁶² Singing loudly folk-songs also kept them alert during day time.⁶³

Sickles and swords were needed by the Tamils for reaping the ripe ears of corn.⁶⁴ The grain was separated by thrashing the sheaths and ears of corn on the ground. The buffaloes were made to tread the sheaths to unloosen the remaining corn.⁶⁵ The ears of millets were thrashed under the foot by persons in order to separate the millets from ears and that of black gram were beaten by a stick.⁶⁶ The participation of women in this work was remarkable.

Fertilisers

The knowledge and experience of the ancient Tamils in manuring the land in the then existing conditions were really great. Though they were not aware of the chemical fertilizers of the modern times, they knew how to make use of the available materials. It was the duty of the king to safeguard the life and property of the subjects; for that he could give any sort of punishment including capital punishment, to the guilty; similarly, it is an essential duty of the agriculturists to take care of his land and remove the weeds which affected the quality and quantity produce and bred the unwanted germs and insects.⁶⁷ To strengthen the fertility of the soil and clear the land of pests, fertilisers were to be used.

In the Sangam age, the dung of cow and sheep (animal manures) and green leaves (green manure) were used to increase the yield and grow varieties of crops. Valluvar insists that

manuring is more important than ploughing.⁶⁸

If the fertility of the soil was maintained, a tiny piece of land where a female elephant might rest could produce enough food for seven male elephants.⁶⁹ Hence the ancient Tamils increased the fertility of the soil by using the necessary manures.

Measurements

Various measurements were used to measure the land, grain etc. The small land was known as 'ma' and bigger one as 'vēlī'⁷⁰ One *veli* was equal to 100 *Kuḷis*,⁷¹ *Tūni*, *Nāzhi*, *Chēr* and *Kalam* were the cubic measurements; *tulām* and *Kaḷajī* were the weights used for measuring the produces. Common vessel for measuring the grain was *ambāṇam*; *Nāzhi*,⁷² *Padakku*, equivalent to two *marakkāls*⁷³ were also known to the ancient Tamils. *Paḍi* was unknown to them. The cubic measurements were of the shape of a wine cask with a broader waist with a slightly narrow bottom and top. They were tightened and fixed by metallic bands.⁷⁴ Balance known as *tulākkōl* was also in vogue.

Land administration

Land was the immovable property and as the administrator, the king had a share of the land produce. It was known as *iṟai* or *Karai* or tax or *vāri* measuring income. Though it is not clearly stated in any Sangam literature it is believed that 1/6 of the produce was collected as tax.⁷⁵ During times of floods and famines, cultivation was much affected and kings were kind enough to make remission.⁷⁶ There are various instances in which the kings donated tax free lands to poets, Brahmins educational institutions and hospitals.⁷⁷ Such tax free land to Brahmins was known as *Brahmateya* lands.⁷⁸

Taxes were collected by *Vāriyār* and *Kāvidi* and the revenue officials were assisted by *Āyakaṇakkar*.⁷⁹ The care taken by the king in the welfare of the people is known from the his revenue administration. The people had not revolted against the king he himself looked after the various basic needs of the people through *Vāriyams* or Boards. There were granaries in public places as well as in the houses of the farmers so that people would not suffer in times of floods or famines.

The *maṅṅram* (council) of the village would take necessary decisions to safeguard the interests of the people.

Participation of Women

Women had taken keen interest in agriculture. Women toiled at home as well as in the field. Many agricultural operations except ploughing and digging, were done by women especially of the lower class or the last class (i.e.) *Kaḍaisiyar*.⁸⁰ The removal of weeds and transplantation of seedlings and sapplings were the main jobs of women. They only safeguarded the grains from birds and animals during day time. Sheds were built for girls for this purpose on an elevated piece of land or on the branches of trees. Incidentally, these agricultural lands became the meeting places of lovers in the Sangam age. Never women enjoyed ownership of land in the Sangam age but a woman was given importance as she would be given a share of the property in the form of *Śtridhana*. During harvest seasons, not only the services of women but also that of children were utilised. In clearing the grains and loading and unloading the same, the women played an important role. It is really sad to note that after the day's work was over, it was the women folk who had to resume the household work and child care untiringly. It was the fate of the lower class women to slog throughout the day with less recognition.

Conclusion

In the *Marudam* region, fertility of the soil, ample supply of water and artificial irrigational facilities made agriculture a flourishing, attractive and noble profession. The poets of the age, especially Tiruvalluvar had praised the farmers sky-high. In course of time, the farmers had developed better methods of ploughing, irrigation, weeding, manuring etc., which enriched the produce, in turn the state itself. The Sangam Tamils' notions of classification of lands, selection of soil for respective produces, application of different methods of cultivation in successful manner, use of manures etc., make one feel that they had reached their heights even in the very early years of civilization in the Tamil country. Great prestige was attached to ownership of land and everyone aimed at having a small piece he could call his own. Selling and buying of lands was

common. Village was primarily a settlement of peasants and its assembly (*manram*) mostly an association of landlords. Besides the land owners—great and small, there was a class of landless labourers, and agrarian proletariat, who assisted in the operations and shared the proceeds of agriculture. If we analyse the various aspects of agriculture in the Sangam age i.e., fertility and classification of soils, irrigation, manuring, harvesting, storage, marketing, participation of women, use of implements etc., with many developments in all these spheres in the modern age, very many of the remote villages in our country still follow the same old methods adopted in the Sangam age.

Compared to the scientific and technological advancement in the modern age, the production ratio in comparison with that of the Sangam people is definitely low.

Hence the Sangam agriculturists are to be hailed that they were capable of producing more with the less available means of communication, transport, implements, fertilisers, devices etc.

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Agriculture in Ancient India and its Social Aspects

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Food is very essential for the creation and sustenance of life. Our ancient sages have actually identified food or *anna* with Parabrahman. While the *Taittirīya Upaniṣad* identifies food with Brahman, a verse in *Chāndogya Upaniṣad* declares that through food comes the end of all ignorance and bondage.¹ Similar thoughts are conveyed in several other texts like *Manu Smṛti* and *Mahābhārata*.² All these and several other references in ancient Sanskrit and other vernacular texts³ prove that our forefathers stressed the importance of consuming good and wholesome food which was made possible only by means of proper cultivation of food articles. Thus agriculture or the art of cultivation became the primary profession of man ever since the dawn of civilisation.

In the prehistoric period man was wandering from place to place and earned his livelihood by hunting and fishing. Due to climatic changes and altered environments, man had to face many difficulties to make his living only by food gathering. His instinct for survival gave him the fresh idea of staying

in one place and cultivating food to pursue nobler ambitions and aspirations in life. This marked the beginning of agriculture in the social and economic history of man. This revolutionary transition, from the food gathering stage to the food producing stage, changed the structure of human society leading to the formation of different social groups, social relations, thoughts, values, etc. Agriculture led to technological progress also and many professional groups came into existence.

If we go through *R̥gveda*, the most ancient literary work of India, we find ample testimony to the fact that agriculture was the mainstay of the people. According to *R̥gveda*, it is believed that the Devas or gods were the foremost among agriculturists.⁴ *Amarakoṣa* also bears testimony to the fact that Aryas were agriculturists.⁵ Agriculture is praised in many ways in the Vedic and other ancient literature of India and this proves the fact that agriculture was practised as a very noble profession. *R̥gveda*, advises the reckless gambler, deprived of his belongings due to addiction to the vice, to resort to agriculture as it is a noble profession that gives man wealth, wife etc.⁶ Manu and Kautilya prescribe *vārtā* as an essential subject to be learnt by a king. *Vārtā* denotes agriculture, cattlerearing, commerce etc.⁷ Patañjali has brought out the importance of agriculture by declaring that a country's economy depends on agriculture and cattle-breeding.⁸ Increase in food production through agriculture is advised in *Atharvaveda*.⁹ Epics like the *Mahabhārata* say that prosperous agriculture leads to the prosperity of a country.¹⁰ Many literary works bear testimony to the fact that great importance was given to agriculture in ancient India.¹¹ The Śrauta and Gṛhya sūtras attach great importance to agriculture and describe a number of ceremonies connected with various agricultural operations like ploughing the field, harvesting of crops, partaking of the first fruits of crops, storing the foodgrains in barns, etc.

Source books:

Plenty of information is available in some of the Purāṇās which reveal the fact that ancient Indians had intimate knowledge on all agricultural operations. Kautilya's *Arthaśāstra*, Pāṇini's *Aṣṭādhyāyī*, Patañjali's *Mahābhāṣya*, the Vanauśadhi varga of

Nāmalingānuśāsana, *Abhidhānaratnamālā*, *Vīramitrodaya* of Mitramiśra, works of encyclopaedic nature like *Mānasollāsa* and *Śivatattvaratnākara*, *Śukra Nīti*, Varāhamihira's *Bṛhatsaṁhitā* are some of the works which testify to the knowledge of various agricultural operations from the ancient period. Technical books dealing exclusively with agriculture were also written and one such available work of 10th century A. D. is *Kṛṣiparāśara*, attributed to the sage Parāśara. This work is also known as *Kṛṣikarmavivecana*, *Kṛṣipaddhati* and *Kṛṣisaṁgraha*. Apart from these, works like *Raghunādana's Jyotiṣtattva* and *Kṛtyatattva*, ancient Tamil works like *Silappadhikāraṁ*, *Kambarāmāyaṇaṁ*, *Tirukkural*, *Tolkāppiyaṁ* and Kannada works like *Lokopakāra*, *Raṭṭamata* etc., contain lot of useful information on agriculture in ancient India. It is said that there is a work called a *Erulupādu* which is an eulogium on agriculture and agricultural class. In vernacular languages there are many proverbs and cryptic sayings in vogue which portray ancient agricultural practices which entered the folklore and were followed by farmers. From these books one is surprised to find that people of ancient India were highly proficient in the art of agriculture and most of the agricultural operations are in vogue today also.

Classification of lands:

To reap the best yield from agricultural operations, the farmer should have a working knowledge of agricultural properties of different types of lands. To arouse an increased awareness of the agricultural properties of lands, according to ecological conditions and biological potentials, our ancient agricultural scientists have classified land, taking into consideration various factors like geographical and climatic conditions, fertility, etc. Lands, according to ecological conditions, were distinguished as *āgnēyi*, *vāyāvī*, *Māhendrī* and *vāruṇī*. Among these, *Vāruṇī* is described as that land where water is available in plenty, is beautiful, fertile, often resorted to by cattle and best suited for growing corns in plenty. Lands are classified as *jāngala* (arid), *anūpa* (marshy), and *sādhāraṇī* (common). *Sādhāraṇī* is described as the best suited for all types of cultivation.¹² In ancient Tamil literature, we find mention of five types of lands, viz., *kuriṅji*, *mullai*, *marudam*, *pālai* and *neidal*. Though

different types of crops could be cultivated in different types of soils, the land *marudam* is often described as filled with cultivated fields yielding plenty of paddy, sugarcane etc. We get a beautiful description of this type of land in *Kaṁba Rāmāyaṇam* in which the great Tamil poet has described the various sounds of agricultural operations that could be heard at the proximity of such a land. Kauṭilya and others have classified lands into several types. Mention may be made of *Kṛṣṭa*, *akṛṣṭa*, *ṣaṇḍha* (for horticultural plantation), *mūlavāpa* (for growing roots), *vāṭa* (for sugarcane) etc.¹³ *Amarakośa* describes twelve types of lands amongst which *naḍimāṭṛka* (watered from river) and *devamāṭṛka* (watered by rain), *sarkarā* (full of pebbles and limestones) etc., are worth taking note of.¹⁴ The arable land was called *kṣetra* an old vedic term pointing to the existence of individual fields carefully measured off and fit for cultivation. It may also be inferred that *halya* was the unit of measurements of lands cultivated with one *hala* and that lands were distinguished as *dvihalya*, *trihalya*, *paramahalya*, *paramasītya* etc. The fields were also classified on the basis of crops grown and also in terms of quantities of seeds required for their sowing, like *vraiheya*, *śāleya*, *yava*, *ṣaṣṭikya*, *prāṣṭika*, *draunika*, *khārika* etc.¹⁵ Ancient Indians knew the quality of lands fit for cultivation. They knew that a subsoil water vein running under a field destroys the grown crops. They were also aware that water only four cubits below the surface of the soil prevents the seeds from sprouting up and makes the grown up crops wither away.

Method of cultivation

The word 'agriculture' means tillage of soil leading to production of crops. The Vedic word *kṛṣi* also denotes agriculture and *kṛṣi* means the act of ploughing. Hence, selection of suitable soil and preparing the soil by ploughing before sowing are very essential and our ancients have given great attention to these aspects. Agricultural operations carried out in those days are summed up in ancient texts as ploughing (कृषन्तः), sowing (वपन्तः), reaping (सुनन्तः), and threshing (मृणन्तः). The bull and the plough were the most necessary accessories for cultivation. In some places horses also appear to have been used to plough the field. Though, generally two bullocks

were yoked to the wooden plough to make furrows in the soil, on ceremonial occasions like sacrifice etc., more than two bulls, were yoked. Sometimes six, eight or twelve or even twentyfour bulls were used. Before tilling and ploughing, the ground was worshipped for a good yield.

The plough was considered the most sacred and essential implement in agricultural operations and was known by different names like *hala*, *sīra*, *lāṅgala*, *sītā* etc. We have heard of kings like Janaka who ploughed the fields themselves, Balarama always carrying the plough and known by the name Haladhara. It is said that *phāla* is a special ploughing instrument with sharp iron edge fixed in the front and this destroyed all insects under the earth. The stumps were weeded out from the ground by a hoe known as *stambaghna*. Since it is necessary to remove weeds, thorns, stones etc., before actual sowing, the special plough known as *lāṅgala* was used extensively drawn by more than two oxen. Repeated ploughing also was done to enable the soil to get the required quality. Ancient texts refer to the preparation of the field by ploughing three times in heavy rain and often by deep ploughing. The custom to plough the field over and over again from one end to other in the reverse direction was in vogue to make cultivation more fruitful and intensive.

Manure

After ploughing the field deeply, the soil was allowed to dry up. There was a general belief that if the soil was allowed to dry up well there was no necessity of adding even manure. This clue is clearly expressed by the Tamil philosopher Tiruvalluvar.²⁰ The same poet has also brought out the importance of adding manure to enrich the soil. *Kṛṣṣiparāśara* and other works prescribe the method of preparing manure from cattle dung, dry leaves etc. Generally, dung manure was used for all types of crops. Soil mixed with honey and ghee was also considered good.²¹ The poet Kamban, while describing the city of Ayodhyā says that the flow of milk from the udders of hundreds of buffaloes, which were anxious to feed their young calves, enriched the soil to yield plenty of foodgrains. It is also said that the drain waters flowing from the kitchens

of farmers made the crops grow well. Ancient farmers knew several methods of keeping the land fertile. They knew that the crops drew sustenance from the earth. Elaborate rules for the preparation of different kinds of manure are given in texts like *Agnipurāna*, *Bṛhatsamhitā* etc.²² Sesame, cowdung, barley powder, beef, fish and water mixed in fixed proportions were regarded as effective manure. Methods of preparing *kuṇapajala*, a fertilizer liquid, are also prescribed for growing crops, flowers, plants etc. Most of the ingredients used were natural organic sources. The knowledge of manure etc., in those days was apparently the result of extensive practical observations and not based on laboratory observations of the modern days. Physical effects of manure upon the texture and water-holding power of the soil were known to the farmers. They had the knowledge of the requirements of different crops and the different harvesting seasons. This might have led to the rudimentary form of crop rotation. This rotation of the crops helped the farmers to improve the fertility of the land. Many a time farmers kept their land fallow — a common practice of keeping the land free of all vegetation for a specified period by occasional ploughing of soil during hot and dry weather. This helped in the removal of infested root and in controlling the breeding up of pests and nematos.

Sowing

Sowing of seeds was carried on after ploughing the field deeply. Ancient texts like *kṛṣiparāśara* prescribe rules for collection and preservation of seeds. Seeds were collected in the months of Māgha and Phālgua. Good, matured, pulpy seeds of uniform character were collected to get good crops. Farmers were prohibited from keeping the seeds on ghee, oil, salt, buttermilk, lamp etc. We have evidences from ancient texts that seeds were treated in a special manner to get special results. For example, to get red tinged cotton, seeds were treated with red lac juice in a special manner.²³ Many botanical marvels were also effected by treating the seeds in special manner.²⁴ Sometimes, ploughing was done in the field while the seeds were already scattered in it. Sometimes two or three different kinds of seeds were sown in the same field. This was done when one was the principal and the other secondary

like *māṣa* and *tila*.²⁵ Auspicious days were selected for sowing seeds like the fullmoon day of the month of *Agrahāyaṇa*. Generally special rituals were performed at the time of sowing and these rituals are fully described in the *Gṛhyasūtras*.

It is very interesting to note that there are many proverbs in regional languages in vogue from the past several centuries, which throw light on agricultural operations of ancient India. They have been serving as guidelines to farmers even now. Through these popular sayings farmers are advised to sow seeds apart from each other. A Tamil proverb says that enough space between two seeds will result in the barn getting filled up with corns. Otherwise, only heaps of straw will rise up. Whosoever sows millet at intervals of one step and jowar at intervals of a frog's leap would be able to fill his barn to its brim.

Weeding and Supervision

After sowing seeds and supplying adequate water to the fields, the farmers were advised to remove the weeds from the fields very carefully and protect the crops properly from birds, insects and rats. The importance of weeding has been stressed in all texts dealing with agriculture. While laying down the duties of a king, Manu in Sanskrit and Tiruvalluvar in Tamil have expressed identical ideas. As a husbandman plucks up weeds and preserves his corn, let a king destroy his opponents and protect his people.²⁶

Agriculture without supervision is fruitless and our ancients made arrangements to strictly supervise the operations related to agriculture. It is advised that the owner of the field must look after the field himself.²⁷ It is justifiably said that if the owner does not look after the field, it will fail him like a wrathful wife. If the owner fails to supervise the agricultural operations, Goddess of prosperity will desert him and in her place adversity will enter his field. Such sayings are popular all over india which emphasize and inculcate the importance of the supervision of cultivation by the owner himself.²⁸

Importance of rains

Cultivation was undoubtedly dependent upon rains to a great extent as it is today. Ancient and mediaeval works frequently refer to rains and speak of rituals and their importance to procure rains. Rain God was invoked by mystic chantings, sacrifices and rituals. A special sacrifice named *kārīrī* was performed for getting plenty of rains. Earth is described as *parjanya* (wife of cloud) because the earth is rendered fertile by the clouds through rains. Tamil poet Tiruvalluvar has included a full chapter on rain just after the invocatory chapter in his famous work *Tirukkural* because of the necessity of rain in an agricultural country. The first poet in Tamil who wrote the great epic *Silappadhikāram* has glorified the sun, the moon and the rain at the beginning of his great work and this indicates that the prosperity of a country depends on the amount of rainfall received by it. Even in the Vedic age, rainfall was often predicted²⁹ and was also ascertained in different regions and thus the produce from different regions were also accordingly ascertained. Farmers were wellversed in meteorology and climatology. Some of the ancient texts contain chapters on the planetary influence on rainfall. After categorising clouds as *āvarta*, *saṁvarta*, *puṣkara* and *droṇa*, these texts give interesting methods of forecasting rainfall in a particular year by observing natural phenomena like the first flash of lightning, course of wind, etc. Immediate rainfall was also predicted from the sudden croaking of frogs, rising of ants with eggs from their holes, dance of peacocks and so on.³⁰

Irrigation

Even though cultivation was undoubtedly dependent on rains to a great extent, and that people new how to collect and conserve rainwater, the system of artificial irrigation was also prevalent from very ancient days. In the Sindhu valley civilization river water was stored by building huge dams and was allowed to flow through channels. In Vedic times, wells were dug and the water was lifted by means of wheels and irrigation was done through long pipes. Frequent references to rivers indicate that people were living mostly near rivers and rivers played

an important role in the social, economic and cultural history of a particular land and its people. Irrigation through canals also was existent in the Vedic period and the word *kulya* is used to mean a canal.³¹ A river is described as a cow and the canal as a calf. Rituals were performed at the time of directing the course of a river and this suggests the opening ceremony of letting river water into a canal.³² In the epic period, there are evidences of huge reservoirs for irrigation and that they were constructed at higher levels so that water could flow down to the fields at lower levels easily.³³ Pāṇini mentions the methods of irrigation with water drawn from the wells.³⁴ Large leather buckets were used for lifting water. Yoked bullocks with ropes were used to lift water from the deep wells for irrigation purposes. Poet Kamban, while describing the beauty of river Sarayū, has mentioned about the canals through which the river reached the peasants.³⁵ Periodic supply of water was done through channels and the *Naradasmṛti* mentions two classifications of dyke, viz., *kheya* (dug into the soil to drain excess water) and *bandhya* (constructed to prevent water from flowing out. It also states that erection of dykes in the middle of another man's field was not prohibited as it was advantageous for irrigation purposes while the loss was negligible.³⁶

History speaks of kings like Bhoja, Skāṇḍagupta, Aśoka, Chāndragupta, Karikāla Choḷa, Rājeṇdra Choḷa and others who took great interest in irrigating the fields. Construction of dams and tanks were considered to be an act of religious merit or *pūrta*. Construction of irrigation works was the most important welfare activity which the State was expected to provide. Philanthropists also took interest in constructing public wells and dams for irrigation. Irrigation works of historical significance like the Sudarśana lake in Saurāṣṭra constructed by Puṣyagupta under Chāndragupta Maurya are mentioned. Several huge tanks with great engineering skill were constructed. Special officers were appointed for the maintenance of irrigational tanks. During Vijayanagar period tax-free land grants were made for the development and maintenance of *anicut*s, tanks, canals etc., to avoid repair and disastrous consequences. Conservation of entire drainage flow for irrigation purposes was also maintained

perfectly. Archaeological excavations, inscriptions, etc., have thrown light on many details regarding irrigation and water-management in ancient and mediaeval India. Many inscriptions speak of the construction, maintenance and administration of reservoirs and canals. The Porumamilla inscription of 1369 A.D. implies that the science of irrigation engineering was well advanced. It was known as *Pāthas śāstra* or hydrology and was studied and followed. The engineer had to be well-trained in ten sciences and he was called *jalasūtra*. Water divining and exploration of underground water was in vogue from very ancient days and this science was known as *dakārgala*. The existence of ground water was ascertained by a study of the growth of certain kinds of plants and trees, anthills, insects, etc on the ground surface. A few works like *Bṛhatsamhitā* and *Śivatattvaratnākara* throw light on this interesting science.

There are plenty of references to wet-crops, especially paddy, in our ancient texts which imply the consequential extension of wet-farming which might have led to a variety of inventions to harness water from natural, surface and subsoil sources. As a result, irrigation had attained a high degree of development. In some places where quantum of flow in the canals was more seasonal and less abundant, canals were connected to a chain of tanks. In purely rainfed areas the dependence was more on subsoil water. Thus surface hydrology and water management were in a highly specialised condition. It is said that different types of irrigation like drip irrigation and pitcher irrigation were in vogue. Farmers themselves controlled the irrigation system and took precautions against seepage, loss etc. The traditional water systems were highly adapted to local agroclimatic conditions. They were the products of generations of experience and required perfect social management to maintain them. The users, like farmers took active interest in water management system. The end-user control and community management systems were prevalent unlike today when everything is under the State-control. Since our country is a thickly populated one, our ancients evolved a vast variety of water harvesting systems for agriculture, drinking and other purposes. The ancients felt the necessity of small water

harvesting structures than bigger dams. There was also the practice of ensuring equal advantages to all beneficiaries of a particular water system. There is lot of scope for research on water management system in ancient India for the historians as well as for the indologists.

Protection of crops

Crops were generally classified as कृष्टपच्य (grown by cultivation) and अकृष्टपच्य (naturally growing in the jungle like the grains *Nivāra* etc.).³⁷ They were further classified according to the time of sowing. Those sown on the fullmoon day of the month of Āsvayuja was called *Āsvayujaka* (autumnal), *Vasantaka* and *graiṣma* crops are mentioned (vernal and summer crops). Kautīlya mentions rainy crops (*vārṣika sasya*) followed by *haimanamuṣṭi* (autumnal harvest) and *haimanasasya* followed by *vasantikamuṣṭi* (vernal harvest) and vernal crops followed by rainy harvests.³⁸

Apart from the usual crops like *yava*, *vrihi*, etc., fibrous plants like hemp, dye-stuffs like *mañjiṣṭa* (madder), *nīli* (indigo) etc., were also grown. Large varieties of fruits and vegetables were also grown.³⁹ Ancient texts like *Suśrutasaṃhitā* and *Carakasamīnatā* provide long lists of various crops which were cultivated in those days. Great care was taken to protect the standing crops from animals, birds and robbers. Observers called *cāvakas* were appointed to protect barley crop from deers.⁴⁰ Shadow figures made of straw called *cañcābhirūpa* were placed in the fields to frighten birds. Care was taken to protect the crops from locusts (*salabha*), hawks (*syena*) and rats.⁴¹

Harvesting operations

During the reaping operations the ripe grain was cut by a sickle and then mowing was done. Then the crops were gathered on the threshing floor called *khala* where grain was separated from chaff.⁴² A special kind of harvesting was done in ancient India as implied by the word उपस्क्रिति mentioned by Pāṇini. In some parts of the country reaping was done, not from one end of the field to the other, but in an unsystematic manner. Some cereals were harvested by uprooting the whole plant.⁴³

Measurement of lands and boundaries

The cultivated lands were divided into different holdings known as *kṣetra*. Some kind of survey of the areas and boundaries must have been done for the distribution of plots among individual peasants. Rules for expressing the area of a field in terms of measures are known as *kāṇḍa*, *kula* etc.⁴⁴ The *sūtra* literature refers to the existence of separate fields or *kṣetras* which were carefully measured off and many a time the fields were enclosed.⁴⁵ It also becomes clear that the ownership of land vested in private individuals who had every right to gift, sell or lease it. If the lands were not enclosed by fences, the boundary was determined by trees, water embankments, anthills, heaps of stones etc.⁴⁶ *Nāradaśmṛti* mentions five types of boundaries viz., *dhvajinī* (trees), *matsyini* (rivers and tanks), *naidhanī* (hidden signs), *bhayavarjitā* (settled by argument of parties) and *rājaśasanātita* (laid down by the order of the king).⁴⁷ Manu and Kautilya have prescribed two kinds of boundaries for land viz., visible and invisible.⁴⁸ *Smṛti* works have laid down elaborate rules of settling boundary disputes between neighbouring landowners.

Impact on society

From the foregoing discussion it becomes clear that agriculture was an important vocation even in pre-Vedic period and rural economy was based upon *grāma* consisting of *kṣetras* or arable lands. Agriculture put an end to nomadic life and ensured regular food supply. This made possible for the agriculturists to settle down on his own piece of land. This gradually led to the peasant village communities and the start of a new mode of life. In course of time, when great empires like Magadha, Chola, Chera etc., were established, the political unification brought about by the rulers, contributed a great deal to the development and improvement of agriculture. Agricultural officers were appointed in different zones and they were expected to be conversant with all the rules and skills related to agriculture.⁴⁹ *Mahābhāṣya* mentions the employment of agricultural labour which enabled the cultivator to relax and do only supervision. Improved cultivation led to the increased availability of different food items which improved

the dietary habits of the people. Because of variegated cropping and availability of pulses and condiments and improved dietary and culinary practices, the nutritional impact of agriculture on society also could be inferred. Because of surplus to feed many, great cities came into existence and developed. Location of settlements along the banks of rivers was determined by the facilities of irrigation and transport they provided.

Farmlands were never diverted to non-farm uses. The biological potential of the soil and the biological wealth of the country were kept up. Agriculture was providing not only food for the people but also more jobs and more income. Different types of plant fibres were used for basketry, mats, rope-making etc. Weaving of textiles became popular and the art of dyeing textiles flourished. The need to transport grains and other goods helped in the development of wheeled transport. It also necessitated the development of new tools and implements as hoes, plough etc., and also food storing devices. Availability of fodder in plenty as a by-product made it possible to domesticate cattle and as a result, veterinary science improved and many books related to this subject were written. Use of pottery and polished stone tools also developed. Apart from food products, technologically useful products were also cultivated such as cotton, hemp, dye-stuffs etc. Technology improved and even the Lothal craftsmen had invented special rotary mill in stone which required less manual labour for grinding corns.

Agriculture and ploughed fields were held in high reverence. Anybody urinating in a ploughed field or extracting seeds from a cultivated field was severely punished.⁵¹ If any farmer was found negligent in his duty of carrying on the agricultural operations in time, the king had the right to snatch away the land from him and hand it over to other man or officer of the village or to merchants.⁵² The foremost duty of a king was to protect agriculture and render assistance to farmers.⁵³ Kauṭilya has insisted that the king and other affluent people should care for the health of farmers. He should grant them 'anugraha' and 'parihāra' to help them to maintain good health and get medical help during sickness.⁵⁴

Agriculture was an important vocation of the people and the agricultural practices had social and religious undertones also. It had become a part of life of ancient Indians, both living in villages as well as in cities. Domestic rites and festivals often synchronised with the four main agricultural operations of ploughing, sowing, reaping and harvesting. Many rites and ceremonies were performed in association with various agricultural operations. Deities like Indra, Pūṣan, Suna sira were worshipped. Agriculture had its magico-religious aspects also. It must be noted that religious practices of several descriptions were intricately woven into the social fabric of ancient Indians and as agriculture was the mainstay of the people, religious rites of superstitious nature were considered necessary for successful agricultural operations.

Agriculture has contributed to cultural development also. Many folk songs, pithy sayings, proverbs etc., came into vogue in different languages. In Karnataka special art forms like *Bayalāṭa* (open air drama), *yakṣagāna* etc., emerged and were encouraged specially by the village folk.

No wonder our country is glorified and worshipped as
सुजला सुफला मलयजशीतला सस्यश्यामला माता।

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- 28-a. यस्यामन्नं ब्राह्मिण्यौ यस्या इमाः पंचकृष्टयः
भूम्यै पर्जन्यपत्न्यै नमोस्तु वर्षमेदसे ॥
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अनुग्रह परिहारौ चेत्यः कोशवृद्धिककौ दद्यात् ॥

Some of The Agriculture, Forest and Animal Produces in Ancient India

PANDIT DR. B. D. DANDAVATE

Agriculture is the only practice or profession known to mankind since time immemorial because it caters to all the necessities of life-from womb to tomb. *Āyurveda* advises practice of agriculture as the foremost means for ensuring livelihood.¹ *Āyurveda* describes three kinds of soils with regard to the flora and fauna., They are (1) Arid land (2) wet land and (3) ordinary land. Peculiarities of the psychosomatic constitutions of men in habiting these lands have been described at length.² All kinds of products can be broadly classified in three groups depending on their sources namely, animal, vegetable and mineral. Substances collected from animal world are honey, milk, bile, fat marrow, blood, flesh, excrement, urine, skin, semen, bone, sinews, horns, nails, hooves, hair on the skin, etc. The mineral produces used in medicine are gold, ores, metals, sand, lime, red and yellow arsenic, gems, salt, red chalk, antimony etc. Substances from the vegetable group are divided into four classes: direct fruiters, creepers, flowery fruiters, and herbs. The plant produce used in medicine are the roots, bark, pith, exudation, stalk, juice, sprouts, alkalies,

milk, fruits, flowers, ash, oils, thorns, leaves, buds and offshoots etc. The rooters are sixteen and the fruiterers are nineteen in number. The principal sources of oily or fatty substances are four. Principal salts are five. The urines as well as the milks are eight. The trees presented in purification therapy are six.³ The milks and urines are of women, shesheep, shegoat, cow, shebuffalo, sheelephant, shecamel, sheass and the mare. Sources of spiritous liquors are the grains, fruits, roots, pith, flowers, stalks, leaves, barks and sugar. All together 84 varieties of *Āsavas* namely medicines containing alcohol generated by process of fermentation are described in accordance with their source materials,⁵ which are mainly agricultural and forest produce.

The substances used for preparing dietary articles and as raw materials for medicines have been scientifically classified. However, both are drawn from the agricultural-forest animal-produce and minerals. The articles of food and drink have been broadly classified in twelve major groups. Out of these, omitting the class of cooked food, the remaining eleven coming under our purview are (1) corns or grains (2) pulses (3) meats (4) vegetables (5) fruits (6) greens (7) wines (8) waters (9) milks and other dairy products (10) sugarcane and its products, and (11) adjuvants of food.

(1) Group of corns: Comprises varieties of rice, coarse grains like wheat and *yava* etc., and the fine grains like कोरदूष, श्यामक, नीवार and others. Names of varieties or species of rice used were (1) रक्तशाली (2) महाशाली (3) कलम (4) शकुनाहत (5) तूर्णक (6) दीर्घशूक (7) गौर (8) पाडुक (9) लांगुल (10) सुगन्धक (11) लोहवाल (12) सारिवाख्य (13) प्रमोदक (14) पतंग (15) तपनीय (16) यवक (17) वरक (18) चीन (19) शारद etc.,

The names of some of the coarse grains are (1) मुकुन्द (2) झिंटाभूटि (3) वरक (4) शिबिर (5) उत्कट (6) वरक (7) वेणुयव (8) गोधूम etc. About 10 kinds of coarse grains were in use.

(2) The groups of pulses or legumes: Comprise of (1) कोरदूष (2) श्यामक (3) हस्तिश्यामक (4) नीवार (5) तोयपर्णी (6) गवेधुक (7) प्रियंगु etc., and others

(3) The group of meats/flesh are subclassified as follows:

(a) The Group of *prasaha*/tearers comprises creatures, animals, beasts, birds etc., such as the cow, ass, mule, camel, horse, panther, lion, bear, monkey, wolf, tiger, heyna, large brownmongoose, cat, mouse, fox, hawk, dog, chasebird, crow, golden eagle etc., (total 29). (b) The group of burrowing creatures comprises four varieties of python, hedgehog, muskshrew, frog, mongoose, and porcupine etc., (total 13). (c) Wetland creatures are wildboar, yak, rheinoceros, hog, buffaloe, elephant, antelope and deer etc., (total 9). (d) A few aquatic creatures maintain on meats of tortise, crab, pearl-oyster, fish, estuarine crocodile, whale, conchshell, catfish, dolphin and crocodile etc., (total 11) (e) The group of aquaticbirds is formed by swan, crane, *krouncha*, goose, pellican, skimmer, gull, *raktasirsaka* and *chakravaka* (total 28) (f) Arid land animals are- spotted deer, other deer species, black antelope, samber, black hare, wild sheep etc., (total 18) (g) The group of gallinacious birds comprise common quail, rain quail, bush quail, चकोर, उपचक्र, कुकुभ, jungle fowl, male bustard, button quail, peacock, partridge, cock, heron, stalk, adjutant, wild partridge, ibis, spoonbill etc. (Total 30). (h) The group of peckers is made of pecker, kingbird of paradise, coucal, common mynah, butcher's bird, *kokil*, *bulbul* cowbird, babbler, scarlet innivet, minivet, Bengal treepie, toukar, hopper, hornbill, green barbet, kingfisher, dove, Indian parakeet, windowbird, blossom headed prakeet, honey succor, *śarika*, house sparrow, tree sparrow paravata and white pigeon etc. (Total 30). Thus ends the class of 158 sources and varieties of meat.⁸

(4) Class of vegetables: Sources of vegetables are many. Anatomical parts of edible pot herbs, plants, shrubs, herbs trees, stems, pods, seeds, fruits, flowery leaves, tubers, roots, bulbs, kernels etc. Names of some of these are: पाठा, शुण्ण, शटी, वासुकम्, मुनिजण्णक, काकमाची, राजक्षवक, कालशळ, कलायम्, उपादिका, मण्डूकपर्णी, कुचेला, नाडी, गोजिन्हा swordbeen, cabbage, onion, radish, prickly gourd, raw mango, red gourd, beens, turnip, double been, cucumber, and mushrooms etc. (Total 46). Vegetable soups are prepared form leaves, fruits, sprouted legumes etc.⁹

(5) **Class of fruits:** Grapes, dates, common fig, sweet falsa, *āsmantaka*, fruits of palmyra, coconut, small, big and jungle jujube, peach, small jackfruit, paravata fruit, Kashmiri, mulberry, peer, woodapple, mango, jambul, apple, banana, khirani, straw goose berry, *kadamba*, *ingudi*, *tinduka*, *amla*, Omegranate, ripe tamarind, pomello, *karchura*, orange, almond, walnut, *abhishuka*, edible pine, *lakucha*, *usumana*, *priyala*, *āmṛātaka*, lemon, holy, fig, yellow barked fig, etc. (total 52),

(6) **Class of greens:** Green ginger, jambeera, tender radish, holy basil, yawani, arjaka, drumstick, fennel, black mustard, gaṇḍira, fogfruit, Indian toothache, sprouts of ginger, ginger grass, celery seeds, corriander, wild carrot, sumukha, turnip, onion, garlic etc. (Total 20). Some of these are used in dried condition also.¹¹

(7) **Class of wines:** Names of some wines are सुरा, मदिरा, जगल, अरिष्ट, शर्करासव, पक्वस, शीतरसिक, मद्यसव etc., and also wines prepared from dhataki flowers, sugarcane, barley grains, grape wine and madhulika wine.¹² (Total 19).

(8) **Class of waters:** All water is of one kind and falls from heaven (i. e., rain clouds). While it is falling, it is affected by the effects of the seasonal courses of the moon, the sun, and the wind. After it has fallen, it acquires various qualities of the soils and the six kinds of tastes in the soil. Waters are classified as (a) celestial water, (b) modified by the receptacle (c) Rain water falling during various seasons (d) water of unseasonal rains is unwholesome (e) autumnal water collected in hygienic condition is good for health (f) water of rivers originating from the Himalays is wholesome and holy (g) River water from the Malaya mountains is pure and like nectar (h) water of rivers flowing westwards is wholesome and pure (i) water of eastward flowing rivers is generally heavy (j) water of rivers originating from पारियात्र, विन्ध्य and सह्याद्रि etc, mountains is unwholesome. (k) Similar is the water from rivers flowing only during rainy season. (l) Qualities of water of tanks, wells, ponds, springs, lakes cascades and geysers is classified on all their counts. (m) The water which is slimy, insect-laden, putrified etc., is unwholesome. (n) The sea or ocean water is provocative of all humors.¹³

(9) The Group of milks and dairy products: All important properties of previously mentioned eight varieties of milk have been described at length. As regards infant feeding, milk of shegoat and cow have been suggested as alternatives in the absence of mother's milk or wetnurse's milk. Astonishingly, contents of proteins, fats, carbohydrates and calories available per 100 gm of sample of each variety are almost the same.

(10) Classes of sugarcane and products: Juice of sugarcane when consumed by chewing and sucking is wholesome. Machine-squeezed juice causes burning. वंशक variety of sugarcane is inferior to पुंड्रक variety. Jaggery increases blood, marrow, fat etc. Jaggery obtained by boiling sugarcane juice down to 1/4, 1/3 and 1/2 its original quantity is crude and immature. Sugar is obtained by further purification of jaggery. Sugarcandy and crystal sugar are extremely pure. Sugar obtained from yasa (camel thorn) is sweet and astringent. Treacle is the most unwholesome. Honey sugar is obtained from honey. Honey is a forest produce available in four kinds, namely bee honey, wasp honey, insect honey, and largebee honey. Bee honey is the best. Old honey is preferable to fresh honey.¹⁵

(11) Group of adjuvants of food: These are used during cooking after cooking, and consumed as such along with food and drinks. Varieties of oils are (1) til oil (2) mustard oil (3) linseed oil (4) safflower oil (5) castor oil (6) priyala oil (7) almond oil and several others. Tallow, marrow and ghee are the fats obtained from animals. Ginger, long pepper, asafoetida, turmeric are plant produce. Salts are obtained from minerals and saline water and ashes of some plants. These are सैधव, संचल, विडलवण rock salt etc. Some of the alkalies are यवक्षार, सर्जिकाक्षार and others. Other food adjuvants are celery seeds, black cumin, cumin, bishop's weed, coriander, and a few plant products.¹⁶

Most wholesome for health as well as most unwholesome from all these have been specifically listed at length.¹⁷

Thus only as a sample, approximately 500 produces obtained from the agricultural forest animal mineral and natural sources are enumerated here.

CONCLUSION

Ancient India was rich in these produces and they were used by the society. Our ancients had established a harmonious use of agricultural, forest and mineral products for a disease-free, healthy and longlife.

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Agriculture in the Time of Patañjali of Mahābhāṣya

DR (MRS.) KALPAKAM SANKARNARAYAN

Patañjali, the last of the three sages, who gave a finishing touch to Pāṇiniyan system of grammar, is notable for his *Mahābhāṣya*. (M. B.) Patañjali undertook the self-imposed task of preserving its chaste character. Patañjali in giving a new setting to the *sūtras* of Pāṇini, availed himself of the opportunity for presenting a picture of India of his time. On this point one entirely agrees with Bhartṛhari, the author of the *Vākyapadīya*, who wrote a running commentary on the *Mahābhāṣya* which has been referred to by Itsing, the Chinese traveller. The account as given by Bhartṛhari in five *ślokas* in his *Vākyapadīya*, is interesting, as it shows how this great commentary was written to preserve the continuity of the *Vyākaraṇa Smṛti*. These references suggest that, when Patañjali wrote his commentary, he tried to put in it the essence of all sciences - the germs of all principles. Those are important, not only for understanding the history of grammar but also in evaluating the *Mahābhāṣya*, and for throwing light on the cultural condition of India in the time when it was written. The *ślokas* may be quoted here in original - (Chp. II. 485)

कृतेऽथ पतञ्जलिना गुरुणा तीर्थदर्शिना
 सर्वेषां न्यायवीजानां महाभाष्ये निबन्धने।
 अलब्धगाथे गाम्भीर्याद् उत्तान इव सौस्तावत्
 तस्मिन् अकृतबुद्धीनां नैवावस्थित निश्चयः ॥

In the words of the celebrated poet, the *Mahābhāṣya* contains the germs of all principles - religious, social, scientific and moral. The *Bhāṣyakāra* could not avoid references to the topics explaining the *sūtras*, or in examining the *vārtikas* of the precursor. A close study of this data considerably helps in fixing the date of Patañjali, but also in revealing the condition of India of his time - social, economic, educational and also political to certain extent. A good deal of information is also supplied by this work on Indian Geography - cities, rivers and villages; and also on other miscellaneous topics. Patañjali in his comments refers to important contemporary events and personalities.

The *Bhāṣakāra* has also referred to the sacrifice performed by Puṣyamitra Sunga, his contemporary. Patañjali, in his comments, refers to important contemporary events and personalities. While commenting on the *Vārtika* of Kātyāyana, and suggesting the use of the present tense (लट्) to denote an action or undertaking which has begun but not finished, he cites an instance: "Here we dwell, we perform (as priests) the sacrifice instituted by Puṣyamitra (*iḥavasāmath - iḥa pūṣyamitraṁ yājayāmaha*)¹. This again, corroborates the testimony of the first reference pointing to the contemporaneity of the *Bhāṣyakāra* with the Sunga monarch Puṣyamitra. Here Patañjali cites Puṣyamitra sacrifices (*yajata*) and the sacrificial priests cause him to sacrifice i. e., to be the sacrificer for performing the ceremonies for him. According to Pāṇini's rule, the order ought to be Puṣyamitra causes (the priests) to sacrifice and the priest (*yājaka*) causes him to perform it, (*yajayanti*). Thus the references to Puṣyamitra—his assembly, and sacrifices, a number of times, show that he may have been his contemporary and helps us to fix the date of Patañjali roughly as early as the middle of the 2nd century B.C. This gives particular value to the *Mahābharatā* as a source of information on the history, on the social and cultural life and in fact, on every subject that concerns India of that period.

Whatever be the grammatical aspects in all the four instances quoted above, it is certain that Patañjali drew his illustrations from important contemporary events to make a deeper impression on the minds of his readers.

A close study of the *Mahābhāṣya* from the cultural stand point unfolds interesting details about social life of his time, as for example, division of society into groups, family life, food, agriculture, household effects, social festivals and other miscellaneous subjects of interest.

The information furnished by the *MB*. about the economic life of the people is exhaustive enough, and suggests a planned economy. As it was natural for a prosperous people to aspire after a greater satisfaction of their needs, planning was essential. Patañjali mentions a good many economic professions. The land was, of course, the primary source of livelihood. The social standard was fairly high as may be judged by the economic condition which covers agriculture to play the major role.

The types of vegetarian food relished by the people of Patañjali's time help us to have the knowledge of the kind of crops cultivated then. They are *Śālī*¹ (paddy of ten varieties) *hāyana*² (a sort of red rice) *yava*³ (barley) and *ṣaṣṭikā*⁴ (another kind of rice ripening in sixty days); some other cereals were *yavañi*⁵ (a kind of inferior barley) and *tila* (sesamum)⁶. The auxiliary edibles popularly known as pulses included *mudga*, *rājamāṣa* and *māṣa*⁷ a kind among pulses having red marks with black and grey spots⁹.

The data furnished by the *MB* might not suggest innovations, but some interesting details are worth mentioning, like different types of land, methods of sowing, agricultural implements, seeds and crops, grain storage and other miscellaneous items.

Agricultural holdings

The arable land was called *kṣetra*. Patañjali explains this term while commenting on the *sūtra*: “सहयुक्तेऽप्रधाने, यदा तु खलु कस्यचिन्माषबीजावाप उपस्थितस्तदर्थं च क्षेत्रमुपार्जिततम्” इति।” *Kṣetra* is an old Vedic term pointing to the existence of individual fields, carefully measured off, and fit for cultivation.¹⁰

Another word, mentioned by Patañjali is *kedāra*¹¹ while explaining the *sūtra* कर्मकर्तारि कर्तृत्वं etc., as लूयने केदारः स्वयमेवेति यत्रासौ i.e., a field under water which is divided by bunds as suggested by Manu -

भूमावप्येककेदारे कालोप्राणि कृषीवलैः

नाना रूपाणि जायन्ते बीजानीह स्वभावतः॥ X.38

The *sutrakāra* distinguishes barren land (ऊषर) from pasture land (गोचर)¹³ but Patañjali has mentioned only the latter one. The area brought under cultivation was known as *halyā* or *sītya*¹⁴. The ordinary cultivator or agriculturist was called *lāngalagr̥ha*¹⁵. The *Bhāṣyakāra* also refers to the general desire for good fields (*sukṣetriyaṣ*)¹⁶. The *Mahābhāṣya* also mentions the employment of agricultural labour, which enabled the cultivator to relax himself, and do only supervision work (एकान्ते लूष्णीं आसीन उच्चते पञ्चभिर्हलैः कृषति इति। तत्र भवितव्यं पञ्चभिर्हलैः कर्षयति इति॥)¹⁷

Prepartions and methods of sowing

Before the actual sowing of the seed, the field was properly ploughed. This was done through oxen, also used for carts (गोतरोऽयं यः शकटं वहति सीरं च)¹⁸. The plough was called सीर। The stumps in the ground were weeded out by a hoe, known as स्तंबध।¹⁹

It was necessary to remove the weeds (तृण) thorns and stones, before the actual ploughing of the land. The required number of ploughs depended on the fertility of the land and its dimensions, the maximum, noticed in *MB* is five (पञ्चभिर्हलैः). After the ploughing of the land, the next stage was the sowing of the seeds, which naturally varied according to crops and seasons. Pāṇini in *hi Aṣṭadhīyī* has referred to different types of fields according to crops as for example, a barely field was called यव्यं यवानां भवनं क्षेत्रं यव्यं इति, that of beans (माष्यं) and sesamum (तिलयम्)²⁰. Patañjali does not distinguish them. As regards the required quantity of seeds for sowing, the *Kāśikā* refers to प्रास्थिकं, द्रौणिकं and खारिकम्²¹ fields, that is, those requiring one *prastha*, *drona* or *khāri* weight of seed; but according to Patañjali, there were fields requiring a hundred (*khārasātika*) or a thousand worth of seeds (*khārasahasrika*)²².

“अन्येष्याऽपि दृश्यते खारशताद्यर्थम् - खारशतिको रशिः। खारसहस्रिको रशिः।”

Sesamum (तिल) and beans (माष) were mixed together in the process of sowing (तिलैः सह माषान् वपति इति।)²³ (तिलैः मिश्रीकृत्य माषा उप्यन्ते). It was also customary to sow seeds on an auspicious day (आश्वयुजी पौर्णमासी)²⁴, though this fact is not mentioned in *Mahābhāṣya*

After the sowing of the seeds periodical supply of water was required for the fields. This was done through canals (शाल्यार्थं कुल्याः प्रणीयन्ते।)²⁵ as it was not unusual to expect drought in that village (विगतः सेचका अस्माद् ग्रामाद् विसेचको ग्रामः)²⁶. The crop was expected to be good if there was adequate rainfall²⁷. देवश्रेद् वृषो निष्पन्नः शाल्यः।

Ripening & Reaping

Some crops ripened early but others took time. Beans ripened quickly (“पचेलिमा माषाः”)²⁸ but another type took sixty days (मुद्गा अपि षष्टिरात्रेण पच्यन्ते)²⁹. The standing crop also needed protection from animals, as well as from robbers. Danger was apprehended for the barley crop from deer (“न च मृगाः सन्ति इति यवा नीप्यन्ते”)³⁰ and so there was the need for an observer (चायक)³¹ (चयन चायक). A shadow figure made of straw (चञ्चाभिरूपः)³² was placed in the field to scare crows and birds, causing destruction to crops; other damages were from mole (आखु), locust (शलभ) and hawk (श्येन)³³ (आखूत्यो वर्तन्। श्येनोत्थः। शलभोत्थः।। When the crop was ready, reaping or cutting (लवन) with a sickle (दात्र)³⁴ was the next step. (अहिहतः नखनिर्भिन्नः दात्रलूनः परशुच्छिन्नः दात्रेण लूनवान्। परशुना छिन्नवान्॥”) The reaper was called (लावक)³⁵ (लवनं लावक इति), probably agricultural labourer, employed on terms which are not mentioned, but, as at present, about 1/16 of the produce was his share. The over ripened grain, requiring immediate attention, is alluded to in the Paninian rule III. 1.125, by the word *lavya*. Patañjali mentions अवश्यलाव्यं and अवश्यपाव्यं³⁶, probably, in a different sense.

Reaping and moving seem to be connected. After the cutting of the standing crop, the produce was stored on the threshing floor (खल)³⁷ for being mowed, which was followed by another process called निष्पाव.³⁸ A winnowing fan (शूर्प)³⁹ (द्वैशूर्पनिष्पावौ) was used by the winnower (तण्डुलिक) who might have been an agricultural labourer, employed for the purpose of separating the grain from the chaff. Farmers kept then threshing floors close by in mutual interest.

Storing

The grain was separated from the chaff, and stored in a granary, called कोष्ट or कुशूल⁴⁰ (कन्दुः कोष्टः कुशूल इति). Both Paṇini and Patañjali mention the agricultural operations with little difference in expression. The latter, in his comment on the, तिष्ठद्वादि सूत्र, refers to खलेयवं खलेबुसं लूनयवं लूयमानयवं पूतयवं पूयमानयवम्⁴¹. In sequence of time, during the performance of these operations, लूनयवं should come first, and the compound indicates the time when barley was reaped, or was in the process of being reaped (लूयमानयवं). The second compound, mentioned as first suggests the storing of the barely crop, or barely straw (खलेबुसम्) on the threshing floor and lastly the separation of the corn from the straw already done, or in the process of being done (पूतयवं - पूयमानयवम्).

Grain was stored in jars, and a person, so doing for a specific period, was called कुम्भीधान्य⁴² (कुम्भी धान्यन्यायेन विज्ञायेत। तद्यथा। कुम्भीधान्यः श्रेत्रिय इति उच्यते। यस्य कुम्भ्यामेव धान्यं स कुम्भीधान्यः इति॥

A good crop was an indication of the prosperous times ahead which could be found out from a single grain of rice (एको व्रीहिः संपन्नः सुभिक्षं करेति)⁴³. Certain crops were associated with definite part in the lands of Uśinara and Madra (उशीनखन्मद्रेफ यवः⁴⁴ and Magadha was famous for शालि or rice (तान्नेव शालिम् भुञ्जामहे ये मगधेषु).⁴⁵

Other crops

Besides barley, rice, pluses, and sesamum, which may be called कृष्णचा - ripening in arable land, there were other crops depending exclusively on nature without human enterprise (अकृष्णचा)⁴⁶. The latter class, probably, included *nīvāra* wild rice which is not mentioned by Patañjali, but is referred to by Aśvaghōṣa (सौंदरानन्द 1.10) as the only food for ascetics. Sugarcane (इक्षु)⁴⁷ cotton (कार्पास)⁴⁸, flax (उमा) and hemp (भङ्ग)⁴⁹ were also grown.

Thus the history and culture of this period has been considered in the light of agriculture which played a major role in the economic life of the people. The importance of *Mahābhāṣya* from this stand point cannot be minimised. Every attempt has been made to corroborate the evidence afforded by this *magnum opus*. It is certainly an authoritative piece or work, but to add weight, other contemporary sources have also been tapped.

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Agricultural Practices Known To Varāhamihira

DR. N. GANGADHARAN

Ancient India has been mainly an agricultural country. Agriculture is given importance even in modern times as is known from the maximum allocation of funds made for it in our First Five Year Plan. Unfortunately, it was relegated to the background in subsequent plans in order to provide for the development of science and technology. The vast Sanskrit literature throws light on the economic conditions that prevailed in the past. Besides the literary works, there are a good number of independent treatises such as the *Kṛṣiśāstra* ascribed to Parāśara, *Abhilāṣitārthacintāmaṇi* of Someśvara, *Viśvavallabhā* of Cakrapāṇimiśra, *Vṛkṣāyurveda* of Surapāla and the *Upavanavinoda* dealing with agriculture. The *Bṛhatsamhitā* of Varāhamihira is one such work devoting some of its chapters to agriculture. The aim of the present paper is to highlight some of the agricultural practices known to Varāhamihira and make an attempt to compare them with modern methods wherever possible.

Varāhamihira, though well-known as an astrologer and astronomer, has also dealt with varied topics in his compendium

Bṛhatsamhitā. Agriculture, arboriculture and horticulture also find a place in this interesting work. Besides an exclusive chapter on *Vṛkṣāyurveda* (Treatment of Trees, Ch.55), we have recommendations to know the influences caused by the positions of the planets.

We understand that two crops were usually raised within a year and that there was rotation of crops. The first crop was known as *pūrvasasya* and the second crop as *aparasasya*. He refers to these terms while describing the effects of the *Bhādrapada* year of Jupiter.

भाद्रपदे वल्लीजं निष्पत्तिं याति पूर्वसस्यं च ।

न भवत्यपरं सस्यं क्वचित् सुभिक्षं क्वचिच्च भयम् ॥ VIII. 13.

They correspond to the present *kharif* and *rabi*. They are referred to as *pūrvaupta* and *Paścādupta* in the *Arthaśāstra* (II. 24). The *pūrvaupta* included all the crops, the seeds of which were sown at the commencement of the rainy season—paddy, *kodrava*, *sesamum*, *priyangu*, *dāraka* and *varaka*. The *paścādupta* comprises the crops, the seeds of which were sown in the autumn - *kusumbha*, *masūra*, *kulattha*, barely, pea, linseed and mustard. Besides these two, the *Arthaśāstra* refers to a *madhyavāpa* comprising the green gram, black gram and *śaibya* Cultivated in the middle of the rainy season. The text points out the favourable and unfavourable positions of stars and planets and the advent of rain at a particular period influencing the growth or causing the destruction of one crop or other viz.,

स्वार्ती निशांशे प्रथमेऽभिवृष्टे सस्थानि सर्वाण्युपयान्ति वृद्धिम् ।

भागे द्वितीये तिलमुदमाषा ग्रैष्मे तृतीयेऽस्ति न शास्दानि ॥

वृष्टेऽहि भागे प्रथमे सुवृष्टिस्तद्वद्वितीये तु सकीटसर्पा ।

वृष्टिस्तु मध्यापरभागवृष्टे निश्चिद्रवृष्टिर्दुनिशं प्रवृष्टे ॥

Bṛhatsamhitā XXV. 2-3

The *pūrvasasya* chiefly consisting of paddy is known as autumnal crop as it would get ripened in autumn. The *aparasasya* mainly comprising wheat and barley is termed as summer crop as they would be ready in summer.

Dealing with the growth of crops in the chapter called *sasyajātaka* (Ch. XL), Varāhamihira explains the good and bad planetary combinations and their interferences that have been declared by Sage Bādarāyana for the growth of summer and autumnal crops, at the time of the entry of the sun into Scorpio and Taurus respectively:

वृश्चिकवृषप्रवेशे भानोर्वे बादरायणेनोक्ताः।

ग्रीष्मशरत्सस्यानां सदसद्योगाः कृतास्त इमे॥ XL.1

Varāhamihira refers to *śukādhānya* (LXI.30) awned or bearded grains and *kośadhānya* (VIII.8) or *śamījāti* (VIII.10) growing in pods or leguminous. They correspond to the modern botanical classes of mono-cotyledons and dicotyledons respectively.

Śukadhānya: The following varieties of rice are referred to by Varāhamihira:

- 1) *śāli*, corresponding to the replanted variety now called *jaḍahan* (V.39; VIII.30 and XV.24) (*sāradhānya*).
- 2) *kālamaśāli*, a variety of rice sown in May or June and ripening in December or January considered as one of the best varieties (XV.5) (*uttamadhānya*).
- 3) *yavaka* (XXXX.3) (It is different from *yava*).
- 4) *sūkaraka* - Hog's rice (XXIX.2) (not mentioned in any other earlier or contemporary work).
- 5) *ṣastika* (As it takes sixty days for ripening) (XXIX.3)
- 6) *raktaśāli* -red rice. It is regarded as the best rice by Caraka and Suśruta (*Br. Sam* XXIX. 2)
- 7) *pāṇḍuka* - Yellowish rice (XXIX.2)
- 8) *niṣpāva* (XVI.33). While Utpala takes it to mean *śāli*, in another context he informs that some regarded it as synonymous with *śāli* and according to others, it denotes a leguminous yield. One is struck with wonder that so many species are mentioned.

Rice and wheat together with barley formed the staple food of the people. *Kodrava* and *kaṅgu* or *priyaṅgu* were also cultivated and eaten by the poor. It is the case even now.

Śamīdhānya: A Variety of pulses was also cultivated. The following are mentioned—*mudga* (XXIX.5), *Māṣa* (XXIX.5),

masūra (XLI.2), *kulattha* (XXIX.5), *kalāya* (XLI.5) and *caṇaka* (XV.14).

Oil Seeds: Varāhamihira refers to *tila*, *sarṣapa* and *sidhārtha* or *sitasarṣapa* among oil seeds. When sesamum seeds yield only half the quantity of oil or no oil at all, great danger is indicated (XLVI. 35).

Fibrous plants: Varāhamihira mentions cotton, hemp *śarā* and linseed (*ataśī*). (XXIX.5; XXIX.6).

Sugarcane: There are many references to the cultivation of sugarcane. There is, in fact, a reference to sugarcane forests:

पुष्ये यवगोधूमाः शालीक्षुवनानि मन्त्रिणो भूपाः।

सलिलोपजीविनः साघवश्च यज्ञेष्टिसक्ताश्च ॥ XV 6.

There are numerous references to the abundant growth of crops and also adverse drought conditions or insufficient rainfall giving rise to famine both being indicated by the good or bad influences of planetary combinations (Chs. XIX, XXIX and XLI). In the year, month or day presided over by the Sun, the earth will yield very little crop (सर्वत्र भूर्किरलंसस्ययुता वनानि XIX.1). During the year presided over by the Moon, the kings will rule over the earth justly and properly and enable the latter to yield a rich harvest of wheat, paddy, barely, *kalama* rice and sugarcane (गोधूमशालियवधान्यवरेक्षुवाटा भूः XIX.6)

During the year ruled by Mars, the crops that grow in the lowlying lands will wither away, and even if they grew, they would be snatched away by robbers (सीम्नि प्रजातमपि शोषमुपैति सस्यं निष्पन्नमप्यविनयादपरे हन्ति XIX.8). During the year presided over by Mercury, agriculture and trade would thrive (वार्ता जगत्यवितथा विकला त्रयी च XIX.11). During the auspicious year ruled by Jupiter, the earth will abound in excellent crops (क्षितिरुत्तमसस्यवति XIX.14). During the year presided over by Venus, the earth will be rich in rice and sugarcane (शाली क्षुमत्यपि घरा घरणी घरामघाराघरोद्भिन्न पयः परिपूर्णवप्रा XIX.16).

When Saturn rules over the year crops will perish in some parts for want of water, in others they grow being watered by artificial means (or as) the Rain-god will yield but little rain.

जातानि कुत्रचिदतोयतया विनाश -
 मृच्छन्ति पुष्टिमपराणि जलोक्षितानि।
 सस्यानि मन्दमभिवर्षति वृत्रशुत्रु (त्रो-)
 वर्षे दिवाकस्सुतस्य सदा प्रवृत्ते ॥ XIX.21

The following methods were adopted for predicting good or bad prospects of crops. Ch. XL (1-4) *Sasyajātakam* describes elaborately the different positions of the Sun and other planets indicating good or bad prospects of a crop. Prosperity of crops could also be known from the profusion of flowers and fruits on certain trees (Ch. XXIX.1-14) *kusumalatādhyāya*, Varāhamihira suggests the following method to ascertain the future prospects of crops. Equal weights of several seeds are taken on the full-moon day in the months of Āṣāḍha and kept for a night sanctified with the *Mahāvratā* hymn. Those seeds whose weight increases the next day will flourish during the year, whereas those that go down in weight will not :

आषाढ्यां समतुलिताधिवासितानाम् -
 अन्येद्युर्यदधिकतामुपैति बीजम्।
 तद्वृद्धिर्भवति न जायते यदनं
 मन्त्रोऽस्मिन् भवति तुलाभिमन्त्रणाय ॥ XXVI.1 (आषाढीयोगाध्याय)

Gardening :

Closely connected with agriculture is plant culture dealt with elaborately by Varāhamihira in Ch.55. Gardening is closely connected with town-planning, house building and construction of tanks. As pointed out by Varāhamihira, gardens should be laid on the banks of tanks since tanks do not look charming without shade on their sides.

प्रान्तच्छायाविनिर्मुक्ता न मनोज्ञा जलाशयाः।
 यस्मादतो जलप्रान्तेष्वारामान् विनिवेशयेत् ॥ LV.1

He has specified the names of the trees to be grown on the banks of the tank.

ककुभवटाप्रपूक्षकदम्बैः सनिचुलजम्बूवेतसनीपैः।
 कुरबकतालाशोकमधूकैर्बकुलमिश्रैश्चावृततीरम् ॥ LV.119

Even in modern times the importance of laying down gardens on the banks of reservoirs has been realised. Maintenance of public parks constituted one of the charitable acts called *purta* in those days. Cities had abundant gardens and parks (LVI.8). Gardens were both artificial (*kr̥ta*) and natural (*akr̥ta*) (LVI.3). Varāhamihira mentions the auspicious trees to be planted in gardens as well as near the houses :

अरिष्टाशोकपुत्रागशिरीषाः सप्रियङ्गवः ।

मङ्गल्याः पूर्वमारामे रोपणीया गृहेषु वा ॥ LV.3.

Temples had orchards in their proximity.

Preparation of the soil and manuring:

A soft soil is helpful for all varieties of trees. Sesamum is sown first of all and crushed when it blooms in order to mix with the soil.

मृद्धी भूः सर्ववृक्षाणां हिता तस्यां तिलान् वपेत् ।

पुष्पितांस्तांश्च मृदनीयात् कर्मैतत्प्रथमं भुवः ॥ LVI.2

This is the first act in the preparation of the soil. This form of green manuring is still prevalent in some parts of India. From the references in this chapter we find that the following are used as manure: cowdung, dung of buffaloes, goats and sheep, clarified butter, *uśīra*, sesamum, honey, *viḍaṅga*, horse gram, black gram, green gram, barley, roots of certain plants, ashes, oil of *śleṣmātaka*, stale meat, beef and marrow of hog.

The *Agnipurāṇa* recommends fish-washing for mangoes. It is reported to be still practised by mango-growers in certain parts of Bengal.²

Methods of propagation:

(1) Sowing of seeds, (2) Grafting, and (3) Transplantation.

1) Sowing of seeds: The general process of sowing seeds is as follows: Seeds are soaked in milk for ten days, taking them out daily with the hand smeared with ghee. Then they are rolled many times in cow-dung and fumigated with the flesh of deer and hog. Then they are planted in a soil that has already been treated (with the sesamum crushing) together

with flesh and hog's marrow. When sprinkled with milk and water, they will grow and bloom.

वासराणि दश दुग्धभावितां बीजमाज्ययुतहस्तयोजितम् ।
गोमयेन बहुशो विरुक्षितं क्रौडमार्गपिशितैश्च घूपितम् ॥
मांससूकरवसासमन्वितं रोपितं च परिकर्मितावनौ ।
क्षीरसंयुतजलावसेचितं जायते कुसुमयुक्तमेव तत् ॥ LV.19-20

The expression *kusumayuktameva* should be noted.

Another method would be to soak any seed hundred times in a paste of *añkola* fruit or in its oil, or in a paste or oil of *śleṣmātaka* fruit and sow in a soil mixed with hail. The seeds would sprout instantaneously and bear fruits.

शतशोऽङ्गोलसम्भूतफलकल्केन भावितम् ।
एतत्तैलेन वा बीजं श्लेष्मातकफलेन वा ॥
वापितं करकोन्मिश्रमृदि तत्क्षणजन्मकम् ।
फलभारान्विता शाखा भवतीति किमद्भुतम् ॥ LIV. 27-28.

Special methods were adopted for making certain seeds with very hard shells such as the tamarind to sprout.

Tamarind: Even a tamarind seed will sprout when sprinkled with a mixture of the flour of rice, black gram and sesamum and wheat particles together with stale meat, and fumigated with turmeric powder repeatedly:

तिन्तिडीत्यपि कपोति वल्लरीं ब्रीहिमाषतिलचूर्णसक्तुभिः ।
पूतिमांससहितैश्च सेचिता घूपिता च सततं हरिद्रया ॥ LIV.21.

Wood-apple: Varāhamihira describes in detail the method recommended for making the wood-apple sprout: The roots of *āsphota*, *dhātrī* (myrabolan), *dhava*, *vāsikā*, *vetasa*, *sūryavallī* (together with the branches and leaves of the last two), *śyāmā* (creeper) and *atimukta* are taken, boiled in milk and cooled. Then the seeds of wood-apple are soaked in this liquid for a period needed for hundred beats of the hand. Then the seeds are taken out and dried in the Sun daily for thirty days. Then they are sown as follows:

A pit one cubit in diameter and twice as deep is dug. It is filled with milk and water. The pit is burnt after it has

become dry. The pit is then smeared with a mixture of honey, clarified butter and ashes. Then it is filled with mud to a height of 3" and then with the flour of black gram, sesamum and barley. Then mud is put over this to the same height. Again it is filled with the flour of black gram etc. An infusion of fish and water is poured on it. Then the entire thing is stirred well until it becomes a thick mass. Now the seed is sown at a depth of 4". Fish water and flesh water is sprinkled over that. Soon a tendril with excellent sprouts would cover the bower.

कपित्थवल्लीकरणाय मूलान्यास्फोटधात्री धववासिकानाम् ।
 पलाशिनी वेतससूर्यवल्ली इयामातिमुक्तैः सहिताष्टमूली ॥
 क्षीरे शृते चाप्यनया मुशीते तालाशतं स्थाप्य कपित्थबीजम् ।
 दिने दिने शोषितमर्कपादैर्मांसं विधिस्त्वेष ततोऽधिरोप्यम् ॥
 हस्तायतं तद्विगुणितम् गभीरं खात्वावटं प्रोक्तजलावपूर्णम् ।
 शुष्कं प्रदग्धं मधुसर्पिषा तत् प्रलेपयेद्भस्मसमन्वितेन ॥
 चूर्णाकृतैर्माषतिलैर्यवैश्च प्रपूर्येन्मृत्तिकयान्तरस्थैः ।
 मत्स्यामिषाम्यस्सहितं च हन्याद्यावद् घनत्वं समुपगतं तत् ॥
 उमं च बीजं चतुरङ्गुलाधो मत्स्याम्भसा मांसजलैश्च सिक्तम् ।
 वल्ली भवत्याशु शुभ्रवाला बिस्मापनी मण्डपमावृणोति ॥LV.22-26

Śleṣmātaka: After removing the shell of the *śleṣmātaka* seeds, they are soaked in water mixed with the paste of *ankola* (alanguium) fruits and dried in the shade seven times. They are then rubbed with buffalo's dung and laid in their dry dung. They are then sown in a soil soaked with hail-water. They will bear fruit in a day:

श्लेष्मातकस्य बीजानि निष्कुलीकृत्य भावयेत् प्राज्ञः ।
 अङ्गोलविज्जलान्द्रिश्छायायां सप्तकृत्वैवम् ॥
 माहिषगोमयघृष्टान्यस्य करीषे च तानि निक्षिप्य ।
 करकाजलमृद्गो न्युत्तान्यह्ना फलकराणि ॥LV.21-30.

2. Grafting:

This method of propagation seems to have been well-known. There was a controversy about the antiquity of this art in India.³ Varāhamihira has recorded two methods of grafting: (1) inserting the cutting of a plant into the root of another

cut off from its trunk, or (2) inserting the cutting of a tree into the stem of another. The junction of the two in both the cases are covered with a coating of mud and cowdung. Grafting may be done in respect of trees and plants like jack, *aśoka*, plantain, *jambū* (rose apple), lemon, pomegranate, grape vine, *pālivata*, *bijapūra* and *atimuktaka* (jasmine).

पनसाशोक कंदली जम्बूलकुचदाडिमाः ।

द्राक्षापालीवताश्वैव बीजपूरातिमुक्तकाः ॥

एते द्रुमाः काण्डरोप्या गोमयेन प्रलेपिताः ।

मूलोच्छेदेऽथवा स्कन्धे रोपणीयाः परं ततः ॥ LV.4-5.

This method of propagation is done in the *śisīra* (February-March) for those plants which have not yet got branches; in the *hemañtā* (December-January) for those that have grown branches; and in the rainy season (August-September) for those that have large branches. The particular direction of the past of the tree that is cut off should be maintained in grafting also:

आजातशाखान् शिशिरे जातशाखान् हिमागमे ।

वर्षागमे च सुस्कन्धान् यथा दिक्स्थान् प्ररोपयेत् ॥ LV.6.

The transplanted/grafted trees should be watered both in the morning evening everyday in summer; on alternate days in the cold season; and whenever the soil becomes dry in the rainy season.

सायं प्रातश्च धर्मर्तौ शीतकाले दिनान्तरे ।

वर्षासु च भुवः शोषे सेक्तव्या रोषिता द्रुमाः ॥ LV.1.

3) Transplantation (*sañkrāmanaviropaṇa*):

The plant meant for transplantation at a distant place are smeared from root up to the stem with a mixture of ghee, *uśīra* (andropogon), sesamum, honey, *viḍaṅga*, milk and cowdung.

धृतोशीरतिलक्षौद्रविडङ्गक्षीरगोमयेः ।

आमूलस्कन्धलिप्तानां सङ्क्रामणविरोपणम् ॥ LV.7.

Distance between trees:

It is very good if trees are planted 20 cubits apart; moderate, if 16 cubits apart and inferior if 12 cubits apart. The trees growing quite close to one another and touching one another with their roots interlocked do not yield fruits in full measure:

उत्तमं विशतिर्हस्ता मध्यमं षोडशान्तरम्।

स्थानात् स्थानान्तरं कार्यं दाक्षाणां वृदशाकुलम् ॥LV.12.

अभ्याशजातास्तरवः संस्पृशन्तः परस्परम्।

मिश्रैर्मूलैश्च न फलं सम्यग्यच्छन्ति पीडिताः ॥LV.13.

Diseases:

Trees catch disease from cold weather, strong winds and hot sun. Consequently their leaves become pale-white, sprouts scanty and sickly, and branches dry. Their milk oozes out:

शीतवातातपे रोगो जायते पाण्डुपत्रता।

अवृद्धिश्च प्रवालानां शाखाशोषो रसस्रुतिः ॥LV.14.

In such cases the trees should be cleared of ulcers and the like with a knife. Then a paste made of *vidāṅga*, ghee and silt must be applied to these parts. They should be sprinkled with water and milk.

चिकित्सितमथैतेषां शस्त्रेणादौ विशोधनम्।

विडङ्गघृतपङ्कजाक्तान् सेचयेत् क्षीरवारिणा ॥LV.15.

When the fruits are destroyed (prematurely), the tree should be watered with milk that has been cooled after being boiled with horse-gram, black gram, green gram, sesamum and barley. Being treated thus, it will have abundant flowers and fruits.

फलनाशो कुलत्प्यैश्च माषैर्मुद्गैस्तिर्यैर्वैः।

कृतशीतपयः सेचः फलपुष्पसमृद्धये ॥LV.16.

The following method is recommended for increasing the yield of flowers and fruits of trees, creepers and shrubs. They should be sprinkled with a mixture of an *ādhaka* of the powdered dung of goats and sheep, one *ādhaka* of sesamum powder a *prastha* of wheat particles, a *tulā* of beef and a *drona* of water kept for seven nights:

अविकाजशकृच्चूर्णस्याढके द्वे तिलाढकम् ।
सक्तुप्रस्थो जलद्रोणो गोमांसतुलया सह ॥
सप्तरात्रोषितैरैतैः सेकः कार्यो वनस्पतेः ।
वल्लीगुल्मलतानां च फलपुष्पाय सर्वदा ॥LV.17-18.

Auspicious trees such as *āriṣṭā*, *aśoka*, *punnāga* and *śirīṣa* and *priyaṅgu* creeper should first be planted in gardens as well as near houses.

अरिष्टाशोक पुत्रागशिरीषाः सप्रियङ्गवः ।
मङ्गल्याः पूर्वमारामे रोपणीया गृहेषु वा ॥LV.3.

I hope some of these methods described in the above paragraphs will have to be experimented and the results investigated in our laboratories.

The foregoing account makes it clear that people lived in tune with Nature in olden days. It is also made clear that in town-planning greater attention was given to the proper maintenance of the environment conducive for the growth and well-being of man pursuing the four-fold purposes of life. In contrast, with the increased use of the chemical fertilizers now, natural manure was used in ancient times. Being keen observers of Nature, our ancients had learnt to live in tune with Nature and had moulded their life-style accordingly. The environment, land, rivers, mountains, and the atmosphere were kept free from pollution as against all sorts of pollution found in the present day.

It is high time that we dispensed with the increased use of chemical fertilizers—harmful for the well-being of mankind and explore ways and means of living in tune with Nature.

References:

1. P. V. Kane, *History of Dharmasāstra*, II, p. 157, fn. 370.
2. *Bṛhatsamhitā—A Study*, p. 270.
3. *ibid*, pp. 271-2.

Agricultural Myths And Fertility Rituals In Kalidasa's Works

M. K. SRIDHAR

Introductory:

The pre-historic men had many superstitions, myths, cults, rituals, taboos etc., in connection with agriculture. A great deal of work is done by many scholars on the subjects like agricultural myths, fertility myths, fertility rituals, agriculture goddesses and so on. In this paper I intend to study the 'agricultural myths' and fertility rituals and myths' as appearing in the works of Kalidasa and also on the basis of Vedic and epic texts. By the word 'myth' I understand that a sacred act associated with any ritualistic practice and by the word 'ritual' I mean performing some refer and divine service. Hence a ritual is a worship that is organised. In the words of Lewis Spence 'Rituals speak of details and circumstances of an adoration, when the original reason for a certain ritual becomes forgotten and lost, a myth might arise to account for it; such a myth would of course be secondary in its nature and is more of the nature of a folklore than a myth. Ritual thus arises from an original myth and gives birth to secondary myth

or folklore.”¹ There are certain mythological references to these myths and some times they have spiritual significance.

The primitive society always laid stress on women as they had an essential and an important function of rearing up the young and also transferring the legacy of a tradition to the offsprings. Hence females were represented as generative symbols, as means and source for transferring the cultural traits, habits and traditions inherited through the ages.

The leading anthropologists classify the surviving tribes into three categories: Those tribes managing their livelihood by way of *hunting* or gathering food; the second type is *pastoral*, and the third type the *agricultural*.

A pastoral leader should look after his tribe, should fight against the natural calamities and so his rituals consisted basically of sky and stars. He considered the Sky-God as the supreme and assigned secondary positions to other deities, “On the contrary the agricultural tribes conceived the cult of the mother-earth and her as a female deity”². As Thompson puts it, “Accordingly agricultural society rituals based upon fertility magic must have played a very significant part and it is characterized by the extensive development of magic”³.

Women and the fertility of the soil are inter-connected. “The fertility of the soil retained its immemorial association with women, who had been the tillers of the earth and were regarded as the depositories of agricultural magic”⁴.

Hence some of the beliefs are universal among the agricultural tribes, viz., women are capable of conferring fertility upon the barren land, ‘are capable of causing fruits to multiply in and out of seasons’, ‘a barren woman is injurious to the land’, ‘a barren woman always makes the land barren’, and so on⁵.

These beliefs resulted in the origin of mother goddesses, fertility goddesses, protective goddesses etc.

(a) Mother Goddess Cult And Fertility Rituals:

Fertility rituals are always connected with females. These rituals are present since time immemorial in all the civilizations of the world either directly or indirectly. As Briffault puts

at, "The identification of earth with woman pervades the thought of all stages of culture and pages could be filled with illustrations of the universal equation'. The mother and the soil are alike. In ancient India, at the wedding ceremony, the woman is called seed field, and the priests exhorted the bridegroom saying "Sow her with thy seed". In the Vedic hymns, the earth is the mother of mases, and he is the son of earth'⁶.

This concept of fertility rituals and agricultural myths is present in India since the R̥gvedic times. *Vājasaneyī Saṁhitā* informs us that a queen had a sexual union with a priest at the conclusion of the *Aśvamedha* sacrifice⁷. This was predominantly an agricultural ritual.

Heaven and earth are described as universal parents in *R̥gveda*. *Dyaus* represented the male principle of the universe and *pṛthivī* was the female principle.

Aitareya Brāhmaṇa speaks of the marriage of earth and heaven (IV. 27).

'Sīta, the heroine of the *Rāmāyaṇa* can be considered as an agricultural goddess in the broad context. The word 'Sīta' etymologically means furrowing, an act of agriculture. A clear reference to Mother Earth is found in the *Mahābhārata*, wherein Bhūdevī is termed as the second wife of Viṣṇu (III-141). According to an ancient myth, she was overburdened with heavy population of the world, so she sank down a hundred *yojanas*. Ultimately she sought the protection of Lord Viṣṇu, who in turn assumed the form of a wild boar and lifted her and restored her to the original position.

A cursory glance of the works of Kālidāsa reveals to us the attitude of the poet regarding these concepts. There are stray references to these myths and rituals in a discreet way. We will make a detailed study of his works in the succeeding pages.

(b) Agricultureal Myths & Fertility Rituals In Great Poems:

1. *Raghuvamśarī*

Raghuvamśarī, a *Mahākāvya* in 19 cantos basically deals with origin, evolution and decay of the solar race. Yet the

work has copious references to some fertility rituals and myths as follows.

Dilīpa, while addressing the royal sage and priest Vasistha, speaks thus.

त्वयैव चिन्त्यमानस्य गुरुणा ब्रह्मयोनिना ।
सानुबंधाः कथं नस्युः संपदो मे निरुपदः॥ I. 62

“Oh! Sacrificer, the oblation duly offered by you to the holy fires turns itself into rain for nourishing the crops, or else would be drought”.

तया हीनं विघातमार्त्तं कथं पश्यन्न दूयसे ।
सिक्तं स्वयमिव स्नेहात् वन्ध्यमाश्रमवृक्षकम् ॥ I.70

“How is it Oh mighty sage! that you are not grieved to see me destitute of the same, like a sappling of the hermitage, watered personally bearing no fruit!”

Dilīpa, bereft of issues, compares his state to a barren sappling and eulogises the powers of the sacrifices which are capable of bringing prosperity and progeny through rains and boons. There is an indirect reference to an agricultural myth associated with holy sacrifices.

The lush green crops above to burst forth with seeds is a fascinating and an enchanting scene to look at. Generally some rituals are performed at the time of the bursting of the crops. This natural phenomenon is compared with Dasaratha's queens attaining advanced state of pregnancy in a verse thus:

सममापन्नसन्नस्ता रेजुरापाण्डुरत्रिषः ।
अन्तर्गतफलारम्भाः सस्यानामिवसंपदः ॥ X. 59

“The queens who conceived all at the same time and whose appearances became pale, shone like the thriving of crop with the appearance of the fruits hidden within”.

Month of Śrāvaṇa, the beginning of the autumnal season captivates the attention of Kalidasa time and again. The torrential

rains have inundated the land and there is irrigation all around. Corns make their first appearance and people rejoice and begin worshipping the mother earth, as Kalidasa remarks:

सुवृष्टियोगादिव जीवलोकः सस्येत संपत्तिं फलात्मकेन। XVII. 2

“The human world is satisfied with the corn on the eve of its perfect development, consequent, on timely showers.”

Atithi, son of Kuśa was dear to his people just as the month of Srāvaṇa. कान्तं नभोमासमिव प्रजानाम् XVIII.6

2. Kumārasambhavam

The work deals with the love and marriage of the cosmic couple, Śiva and Pārvati and the consequent birth of Kumāra. Kālidāsa gets ample scope to represent the fertility concept through the above main story. Here fertility ritual is inter-mixed with agricultueal myths. In fact the 2nd verse of the I canto suggests the recurrent theme of fertility, thus

यं सर्वशैलाः परिकल्प्य वत्सं मेरौ स्थिते दोग्धरि दोहदक्षे।

भास्वन्ति रत्नानि महौषधीश्च पृथूपदिष्टां दुदुर्घर्षित्रीम् ॥ I. 2.

“Making whom the calf, all the mountains, with Meru, expert in milking, standing as the milkman; milked (for him) lustrous jewels and efficacious medicinal plants from the earth pointed out by Pṛtu.

The heroine of the epic poem is Pārvati. She appeared as a missile of Kāma (कामस्य अस्त्रम् I.31) and possessed elevated breasts (I.40), a symbol of fertility. She alone is capable of bearing the seed of Śiva among women.

उभे एव क्षमे वोढुमुभयोर्बाजमाहितम्।

सा वा शम्भोस्तदीया वा मूर्तिर्जलमयी मम ॥ II.60

(Only) The two are able to bear the semen, deposited by us two - She (Umā) (that of Śiva) and his watery form, that of mine.

योषित्सु तद्दीर्यनिषेक भूमिः सैव क्षमेत्यात्मभुवोपदिष्टम् ॥

As a pre-requisite to this fertility ritual, we find Pārvati paying respect to Lord Śiva, who is practising penance on the table land of the Himālaya. (Ks III. 16). She continues penance to attain her desire till its fruition. फलोदयान्ताय तपःसमाधये। V.6

Just as the Earth is distressed by draught, Pārvati is distressed being unable to unite with Lord Śiva. Indra, the rain god, should send showers, irrigate the land for prosperity. वृषेव सीतां तदवग्रहक्षताम् V.61. Śiva should unite with Pārvati for bestowing a child on her. Śiva is inclined toward the marriage for begetting a son, just as a sacrificer secures *araṇi* for generating the holy fire. VI. 28, & VII. 47 Āngiras is hoping for an auspicious 'yoking'. तमर्थमिवभारत्या सुतया योक्तमहंसि ॥ VI 79.

Pārvati at the time of her marriage held an arrow in her hand, which is a symbol of love. (सा उपात्तबाणम् VIII. 78). She was waiting for the arrival of the bull-emblem god. VII.29 (वृषाङ्गमनप्रतीक्षः). At the time of the marriage, the couple shone like the brilliance of the Śrāvaṇa month. She is eager to have a union with Śiva, just as the earth being extremely parched by the sultry summer season is eagerly waiting for the first showers sent by Indra.

निदाघकालोलवणतापयेव माहेद्रमम्भः प्रथमं पृथिव्या ॥ VII.84.

The X canto of *Kumarasambhavam* explains an aspect of fertility explicitly. The seed deposited by Śiva was received by the river Ganga (a River goddess), but was troubled by intense fever owing to the world consuming and unbearable, powerful semen; she transferred the same to the bodies of the six Krittikas, who had come for bathing in the river Ganges. They gave birth to Kumāra and nurtured him.

The transfer of Śiva's dangerous energy form Ganges to Krittikas speaks of a fertility ritual and the concept of *niyoga*, very common in the *Mahābhārata* times.

Śiva is referred to by epithets such as Vṛṣabadvaja, Vaṣāṅka, Vṛṣapati, Vṛṣadhvaja, Paśupati, Kṛṣānu *retas* etc., symbolising bull and character of the bull. It is many a time regarded as a symbol of fertility. Śiva represents the powerful masculine force and also a fertilizing force. "The bull is a fertilizing generative power of nature which is manifest also in the sky

as storm"⁸. The vehicle of Śiva, i.e., the white bull, white as the Mount Kailāsa, "represents the fullness of life, and the bright alternating rhythm of life with its many transformations that are symbolically related to the phases of the Moon"⁹. Indra is impelling the Cupid to tempt Śiva for a union with Parvati.

The word *niṣek* caused by Kālidāsa signifies a nuptial ceremony. It is generally done on the same day of the marriage or during Śrāvaṇa month. It is one of the 16 *samskaras* and includes *Garbhādāna* or impregnating the bride, through an official ceremony or rite. Thus Kālidāsa is informing us about an important fertility ritual through these verses.

C. Fertility Rituals & Agricultural Myths in Love Lyrics:

1) *Ṛtusamhāra*

Ṛtusamhāra depicts six seasons in 144 stanzas. The major theme consists of miniature painting depicting amatory situations or sentiments. We get references to agriculture myths in stanzas 1-3, 7, 10-12, 15-17, 19 & 27 of the II canto. The poet describes the clouds as appearing like the breasts of a woman, with child. क्वचित् सगर्भप्रमदास्तनप्रभैः । II.2

The poet compares the earth to a beautiful lady who is not white: विभाति शुक्लेतरत्नभूषिता ।

The autumnal season sends the poet to raptures. Look at this verse:

काशैर्मही शिशिरदीधितिना रजन्यो
हंसेर्जलानि सरितां कुमुदैः सरांसि ॥
सप्तच्छदैः कुसुमभारतैर्वनान्ताः
शुक्लीकृतान्युपवनानि च मालतीभिः ॥ III.2

"The earth is whitened by the *kāśa* flowers, the nights by the moon, the waters of the rivers by swans, the lakes by lotuses, the forest regions by the *sapta parṇa* trees bent with the burden of flowers. and the ground by the gardens."

Further,

संपन्नशालिनिचयाव्रतभूतलानि
स्वस्थस्थितप्रचुरगोकुलशोभितानि ।
हंसैः ससारसकुलैः प्रतिनादितानि
सीमान्तराणि जनयन्ति नृणां प्रमोदम् ॥ III.16

“Men are delighted by the numerous fields, wherein the ground covered by lines of rich rice crops which are charming with many herds of cows lying undisturbed and which are resonant with swans and flocks of cranes”.

The great poet describes the beginning of the fertility ritual and the conjugal bliss of the females. Just as the rich, rice crops in the numerous fields excite the minds of the farmers, in the same way the women glorious in all their limbs, heighten the passion of men. प्रभूतशालिप्रसवैश्चित्तानि IV.8

Everywhere the village fields are full of rich and ripe rice परिणत बहुद्वालिण्याकुलग्रामसीमा and the farmers are rejoicing owing to the fertile lands. The earth being fertile denotes that love is exuberant everywhere प्रकामकामम् V.1

The poet compares the earth to a newly wedded bride with red garments. रक्तांशुका नववधूरिव भाति भूमिः। VI.19 The earth itself appears like a young bride wooing her beloved, may be a king or a farmer of connoisseur of art or a Nature lover. It is interesting to know that goddess सरस्वति is also an agricultural goddess. She has an appellation शारदा i.e., relating to autumn. She is white and bright as the autumnal season. शारदा vrata is observed in the चातुर्मास्य season for prosperity in education (This is the view of the author).

2. Meghadūtām :

In the love lyric, the hero Yakṣa one day sees a cloud clinging to a hill on the first day of Āṣāḍha month and remembers his parted and pining wife. He praises the cloud in many ways and requests to be a messenger to convey a message for his wife. The cloud is capable of making the earth fertile कर्तृ यच्च प्रभवतिमहीं अब्धिलीन्यां अवन्ध्यां I.11 and the rays of the Sun can impregnate a cloud, गर्भं दधत्यकमरीचयः RV XII.4

The earth surrounded by hills appears like the breast of mother earth, dark in the middle and white in the rest of its expanse— मध्ये शामः स्तन इव भुवः शेष विस्तार पाण्डुः I.6

Srāvāṇa month excites the passion and activates the energies of the lovers, farmers, poets and the common man. The farmers begin to cultivate the land vigorously and nurture the seedlings and the crops pregnant with seeds.

d) The concept in dramas - (1) Mālavikāgnimitram.

Kālidāsa introduces a powerful agricultural myth and a corresponding fertility myth through his work *Mālavikāgnimitram*. Dhārini, the chief queen, is very much worried as the aśoka tree has not yet bloomed with flowers although spring season has set in. उत्सुका खलु एतस्य तपनीयाशोकस्य कुसुमोद्गमे. She instructs Mālavikā, the heroine to perform दोहदक्रिया.

Dohada primarily means “ardent longing”. It is derived from the root *doha*. It gives various shades of meanings such as longing of a pregnant woman, pregnancy, the desire of plants at the budding time, vehement desire, foetus, 10. Yājñavalkya says in his *samhitā*

दोहदस्याप्रदानेन गर्भो दोषमवाप्नुयात्।

वैरुष्यं मरणं वापि तस्मात् कार्यं प्रियं स्त्रियाः ॥ III 79

“The foetus may become defective if *Dohada* is not performed. It may become deformed or even die. Hence this ritual is dear to women.”

Dohada poetically is supposed to exist in plants desiring to be gently kicked by fair ladies, in order to put forth flowers or fruits; then secondarily it is applied to anything which produces such desire.

तरुगुल्मलतादीनां अकाले कुशलैःकृतम्।

पुष्पादि उत्पादकं द्रव्यं दोहदं स्यात् ॥ शब्दार्णव

A commentary on *Naiṣadhiyacharitam* I. 82 says अतिशयित फलभिः समृद्धिः येन भवति दोहदम्. There is a reference to that *kriyā* in *Raghu varṇā* VIII.62 *Naiṣadha* III. 21, *Meghadutam* 78.

Aśoka tree would receive the treatment. The vernal beauty with gleaming red aśoka is said to excel the paint applied to Mālavikā. She is embellished with ornaments and lac dye to perform the *dohada* act. यावत्सालकं सन्तुरं करेमि III Act.

The red paint laid upon her feet excites the passion of the King III.11. Mālavikā gently kicks the aśoka tree. The tree gets horripilated and bursts forth with flowers. She is rewarded by way of winning the heart of the King through this act.

Red colour is the renewal of life. It is a fertility symbol, and represents the menstrual discharge and "sometimes is appropriate to the female figurines supposed to represent mother goddess and mother earth."¹² To quote G. Thompson "It is a worldwide custom for menstruating or pregnant women to daub their bodies with red ochre, which serves at once to warn the men to keep away and to enhance their fertility. In many marriage ceremonies in India, the brides forehead is painted red, a sign that she is forbidden to all other men, save her husband and a guarantee that she will bear him children"¹³.

"The grandeur of red is found in the festival of Holi which is a ritual of fertility connected with the theme of death and resurrection."¹⁴

Generally, the desires of a pregnant women are fulfilled by their husbands. It is opined by modern psychologists that the mode of thinking good or bad by pregnant women has a direct influence on the growing foetus; we hear a number of ancient Indian stories in which persons, kings and others were engaged in extraordinary feats to fulfil the desires of their pregnant wives. The *Maṅgala Gouri Vrata* observed by married women at the onset of Śrāvaṇa month is primarily a fertility ritual. They use betel leaves, nut, red cloth each, 16 in number which represents the age of young girls who are in the prime of youth. At the end of the *vrata*, the jar containing sweets is given as *dāna* (gift) to their mothers. Here the jar is a symbol of uterus.

Even the *seemanta* ceremony performed represents a fertility ritual. The pregnant woman is adorned in a green *sāri*, which

is symbolic of prosperity and fertility. *Om̄kara* is played upon the lute and the performers hope that the kid in the mother's womb hears the same and the psychic breath is infused into the kid through these ritual acts.

Thus *aśoka dohada kriyā* in *Mālavikāgnimitram* represents mixture of fertility ritual, an agricultural myth and a funeral rite existing in Kalidasa's times.

2) *Vikramorvaśiyam* :

The entire drama symbolically, represents an ancient fertility rite and a myth. The episode of Purūrava and Ūravaśi is found in the *Ṛgveda* for the first time X.95. Keith is of the opinion that 'the *Ṛgvedic* hymn is of considerable interest and antiquity. The hymn clearly refers to one of those alliances of nymphs and men, which are common in all literatures as in the stories Thetis and the German swan maidens, who often for as long as 7 years are allowed to stay with mortal men, the taboo of seeing the hero in naked is of interest and primitive in nature.¹⁵

Śathapatha Brāhmaṇa 11.5.1 gives an interesting account of the above episode, wherein the two conditions of Ūravaśi in order to stay with Purūravas is highlighted. The same narration can be found with little variation in *Sāyaṇa Bhāṣya* on *Ṛgveda Sūkta*. As many as 8 different sources of the same episode have been enlisted by western scholars.

From the stand point of fertility rituals, the *Śathapatha Brāhmaṇa* account is quite interesting. "He then made himself, an upper *araṇi* of *aśwattha* wood and a lower *araṇi* of the same', and the fire which resulted therefrom was very full by offering which he became one of the Gandharvas. Let him, therefore, make himself an upper and a lower *araṇi* of *śvattha* wood, and the fire which results therefrom will be that very fire; by offering it he becomes one of the Gandharvas."

Here 'Pururavas and Ūravaśi are compared to the sacrificial woods *araṇi*, the fire is generated by a friction of these two pieces of wood. Their son is Āyu. Agni has an epithet of Āyu also.¹⁶ Puru was a mortal. He became popular in the three worlds owing to his daring exploits. The gods encouraged

him and used him against the battle with the demons. He ought to have been given an immortal status. But it could not, probably it would not be possible without his death and resurrection. Hence, they ushered in the *taboo of nakedness* through the episode of Ūrvaśī. He was given the status of a Gandharva at the end of the sacrifice.

3) *Abhijñanasākuntalam*:

Only scant information is available with reference to the above in this drama. Kaṇva, the sage considers the marriage of Duṣyanta and Śakuntalā as a holy sacrifice (Echo of *Vikramorvaśiyam*). The venerable sage is glad that the “offering of the oblations has fallen right into the fire”. Even, the heavenly voice substantiates the above statement in a verse thus.

दुष्यन्तेनाहितं तेजो दधानां भूतये भवः।

अवेहि तनयां ब्रह्मन् अग्निगर्भां शमीमिव ॥ IV. 4

“Oh sage! know that your daughter bears within her for the prosperity of the world, the glorious seed implanted by Duṣyaṅta as the Śami tree holds fire in its interiors”.

Śakuntalā is compared to the mother earth which is fertile. Śarṅgarava commands the King to accept her “Who is now with a child for joint performances of religious duties”.

आपन्नसत्त्वे प्रतिगृह्यतां सहधर्मचरणायेति। V act.

The King compares Śakuntala to a fertile land where the seed has been sown in proper time for e.g.,

सरोपितेऽप्यात्मनि धर्मपत्नी त्यक्ता मया नाम कुलप्रतिष्ठा।

कल्पिष्यमाणा महते फलाय वसुन्धरा काल इवोत्तबीजा ॥ VI. 24

“That lawful wife of mine, the mainstay of my line, was rejected by me even after my own self had been implanted in her, as one would reject the land in which the seed had been sown in proper time and which was to yield a mighty harvest”.

Mārīca compares the triad to faith, fortune and formality which are the 3 pillars of a sacrifice (VII.29). Kaṇva had

termed their marriage as a holy sacrifice and the same point is emphasised by Mārica in the VII Act. The king is united with his wife and son, a sign of prosperity. Mārica confers upon a boon on Duṣyaṅta thus.

तव भवतु बिडौजाः प्राज्यवृष्टिः प्रजासु।
त्वमपि विततयज्ञो स्वर्गिणः प्रीणयस्व ॥ VII.34.

The belief and the myth that the King is dependent on Lord Iṅdra for rains and Iṅdra is dependent on the king for sacrifices is evident here

CONCLUSION

From the information collected above we come to know that agricultural myths, fertility myths and fertility rituals were there during Kālidāsa's time. Kālidāsa equated the barrenness of women to the barrenness of the land and compared the pregnant women with offsprings to a land prosperous with crops. Kalidasa was of the opinion that marriage was sacred and compared it to a ritual of sacrifice. He held the view that a healthy marriage should end in progeny, just as the fertile land shining with crops.

Kalidasa eulogised the Śrāvaṇa month as it was capable of bringing joy and prosperity to the farmers in particular and the people at large. He even approved the concept of *niyoga* as taken from the example of the birth of Kumāra, which is an important aspect of fertility rite. He recognised the importance of fertility rituals and agricultural myths in the life of man and hence gave a thrust and importance to them through such depiction of *aśoka dohada*, *niṣeka* and other fertility rites. Kalidasa appreciated the fertile land and the exuberance of love and dalliance indulged in by newly weds in the fertile month such as Śrāvaṇa. He worshipped the woman and earth as *prakṛiti* or *Śakti* and gave her a spiritual status and a meaning. *Puruṣa* in association with *Prakṛiti* only is capable of creation for the overall progress of society. Thus I would like to conclude with a reference from Marshall who rightly observed that:- 'In the later Śākta phase of the primitive mother goddess cult, the *devi* is transformed into the eternally existing all powerful female principle, the *prakṛiti* or *Śakti* and having been associated with the male principle, the *Puruṣa*, she becomes Jagadambā or Jagamātā—The Mother of the Universe, the Creator of

the gods. In her highest form She is Mahādevī, the consort of Śiva, but in spite of her being consort of the latter, she is the Creator.'¹⁷

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Magic in Agriculture

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Magic plays an important role in the life of human-being. The sacraments and sacrifices, ceremonies and festivals are linked with magic in some form or the other. Even fields like agriculture and warfare have not remained unaffected by magic.

Indian farming depends on rains. No wonder, many a rite is practised to get either good rains or good crops. The fertility of land and growth of crops are also to be ensured. The crops are to be protected from insects and worms. All these are linked with 'Soma Sacrifice', *Maṇḍūka Sūkta* (to propitiate the frogs as they are supposed to be the carriers of rain), *Śakvarī*-song, Gokulāṣṭamī celebrations, marriages of plants and deities, female-deity worship and similar practices.

Let us see how the above mentioned devices are used in agriculture in India.

Magical devices to ensure rains

a) **Soma Sacrifice**

Soma is the name of 'Soma plant' as well as of the moon. The moon is the Lord of waters. Aitareya-Brāhmaṇa says that that the rain comes from the moon.¹ The moon lies in the womb of waters and is known as *apām peru* i.e. an impregantor

of waters.² The moon is also addressed to as 'retodha' the sustainer of virile semen in the Vedas.³ Even the Purāṇas mention that the chariot of the moon equipped with horses and charioteer, comes from the womb of the waters⁴.

The terrestrial Soma, i.e. the Soma plant is the replica of the celestial one, i.e. the moon. So, the plant is attributed as the rain giver. The plant is described as the king of waters and the offspring of water. A few illustrations are cited to support the point.

“Pour down the rain upon us, Pour a wave of waters from the sky and plenteous store of wholesome food.”⁵

“The drops of Soma juice effused fall like rain upon the earth.”⁶ Indra is the deity who releases the rain. So 'Soma' is mentioned as one approaching the heart of Indra. “He, Pavamāna, has streamed through the fleece-then he runs into the jars finding his way to Indra's heart”⁷

Soma sacrifice is a device for getting rains. Rgveda mentions Parjanya (the rain) as the father of the 'mighty bird' i.e. of the Soma. So the son, being propitiated, brings the favour of the father.

A few illustrations are given to strengthen the point.

He (Soma) creates the waters, he makes the heavens rain “Through your purification create rain for us, from the sky, the wave of the waters.”⁸ “Pressed drops, bring riches to us, purifying yourself”. Let the sky rain, Let the water flow.⁹ Pour on Oh! Pavamana' rain....¹⁰ Pour on us rain celestial, quickly streaming, refreshing, fraught with health and ready bounty.¹¹

b) Maṇḍukasūkta and marriage of frogs

Maṇḍukasūkta¹² a hymn from Rgveda remains a riddle for traditional Indian scholars including Sāyaṇa and the foreign scholars, as they could not trace the continuity between the stanzas of the hymn.

1st to 6th stanzas of the hymn are nothing but the praise of frogs. These frogs gather round the pool to honour the

first day of rain time. They have lifted their voices and have come forth granting riches. They have vouchsafed the treasure.

In the 7th and 8th stanza, appear the 'brāhmins' sitting around the vessel of *Soma*, talking of *Soma* rite 'Atirātra'. Here we have to find out the relation between frogs and the brahmins, which would justify the entire hymn as a continuity. Anyhow this point has remained unnoticed by the scholars.

While interpreting, the western scholars take the hymn as the panegyric of frogs, clearly a satire on the priests.

Oldenberg and Macdonell find it difficult to synthesize the stanzas in the hymn and hence mention it as 'a satire of priests'.

To me, the entire hymn depicts a magical rite performed by the Brahmins to ensure the rains. The Brahmins are imitating voices of frogs as a device of rain magic. This is similar to the practice in Queensland. Frazer gives the account as follows, 'At Roxburgh, in Queensland, an artificial pond is made in the ground. Men, who come forth dancing and singing round the pond, mimic the cries and antics of various aquatic birds and animals such as ducks and frogs which are believed to ensure the rains'¹³.

If *Mandūkasūkta* is interpreted in this way as a magical rite performed by Brahmins to ensure rains conflict between the stanzas of the hymn would altogether disappear.

This interpretation would also justify the tradition of arranging the marriages of frogs which exists in Dibrugadha in Assam. These marriages are believed to result in rains, good crops and fertility.

c) Śakvarī song

This is a prayer offered to Lord Indra¹⁴ which is to be uttered by a pupil, clad in black garments with black trimmings. These black garments signify 'black cloud'. The pupil who is an ally of the water, by means of uttering the prayer, propitiates Lord Indra, reminding him of his heroic deed of releasing waters and sending the rivers to the earth. This causes rains in accordance with the magical formula, 'Like produces like'.

d) Gokulāṣṭamī festival

This festival is observed on the eighth lunar day in the black half of the month of Śrāvaṇa. The youngsters imagine themselves as the 'Govindās' i.e., the cowherds. Forming a pyramid in a 'towerlike shape they break to pieces a jar, tied at height. Curds in the jar is made to fall on the Govindās. This curd symbolizes semen while the water which is thrown on these 'Govindās' by women stands for the rainfall. Thus the festival is a magical device for the rain and prosperity.

Propitiating raingod by giving a magical turn to the rite can be noticed even in the practice of *Abhiṣeka* (i.e. pouring water) on the *Śivaliṅga*. This is practised when there is a drought.

Charms to safeguard the crops

It would be interesting to note that there are a variety of charms for the growth of crops, also to prohibit rats and other creatures from eating crops and thus to safeguard them from harm. These charms are found in *Atharvaveda*. A few illustrations are cited below.

“Raise thyself up, grow thick by your own might. O grain! Burst every vessel. The lightning in the heavens shall not destroy thee.” “When we invoke you, god grain, and you listen, then you raise yourself up like the sky, be inexhaustible as the sea.”¹⁵

“O, Nabhasaspati, keep strengthening food, in our house, may prosperity and goods come here”¹⁶ “Shut their (of those creatures who hurt the crops) mouths, that they shall not eat barley.”¹⁷

Role of Female deities in agriculture

Female deities play an important role in the magical phenomenon of making the land fertile. They also vouchsafe growth of crops. Maidens and married women are worshipped as they represent the female deities. Idols of female deities are also propitiated by observing festivals. These female deities stand for generating power and fertility e.g. an image of woman generating a tree from her womb was found in the excavations of Indus valley civilization. R. C. Dhere has explained *Lajjāgaurī* images in his book *Lajjāgaurī* saying that they stand for fertility.

Śaktipūjā is an important component of Indian tradition. One illustration of *Durgāpūjā* is explained here to point out magical aspect in it.

The image of Durgā bears moon on her head. The scholars have not given any justification of the existence of the moon on the head of a deity. To me, the moon, as is pointed earlier in this paper, stands for semen. This semen is united with 'Śakti' the goddess, and thus fertility to beasts, men, plants and land is extended.

Black goat is offered to the deity. The colour of the goat resembles the cloud and the bloodshed which takes place when the goat is offered symbolizes the rain. The jar filled with water which is installed as an auspicious symbol during the course of worship stands for generating power.

Marriages of deities

Tulasī Marriage - *Tulasī*, the sacred plant, stands for the goddess Lakṣmī who is married to Bālakṛṣṇa, a form of Lord Viṣṇu. The marriage is celebrated on the eleventh day of the white half of the month of Kārtika, when Lord Viṣṇu wakes up from his sleep in the sea. His awakening from waters, symbolizes accumulated procreative energy. The marriage results in abundance of crops fertility and progeny to human beings.

Same is the reward gained by celebrating the marriages of Rāma and Sītā, Śiva and Pārvatī, the Sun and the Earth.

Indian scriptures, thus contain a number of references to the magical rites to be performed in agriculture. While these are not mere descriptions but a manner of inducing the environmental energies to generate and produce. Thus these gain a meaningfulness as magical references. The above exercise is an attempt to survey these magical aspects in our ancient lore.

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3. *Rgveda* 9.86.39

100/ Agriculture in Ancient India

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रथः साश्वः ससारथिः ।
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Glimpses of Kṛṣiparraśarah

(A Sanskrit work devoted exclusively to different
agricultural operations.)

Dr. RAVINDRA VAMAN RAMDAS

Innumerable references to agriculture in the R̥gveda attest that agriculture has been playing a vital role in the economy of Bharat. One would expect a number of specialized works on the subject. However, कृषिपरशरः is the only Sanskrit work of its kind so far available.

The work has been edited and translated by G. P. Majumdar and S. C. Banerji and published by the Asiatic Society of Calcutta in 1960.

There are two other titles, *Kṛṣi Śāsana*, which is nothing but a compilation of passages, relating to agriculture, culled from different sources. The anonymous MS No. 5276 called *Kṛṣi Sastra'* (Appendix) deals only with the time suitable for some of the items of agricultural operations; the author in the second verse promises to set forth the time for agricultural operations 'समयम् कृषिकर्मणः'².

The introductory verse tells us that Sage Parāśara is relating *Kṛṣi Karma - Vivechanam*. We are not able to tell whether

the author Parāśara is the same who wrote *Parāśharasmṛti*. Varāhamihira, the renowned astronomer refers to Parāśara as an authority on astronomy as well as cattle science in his *Bṛhat Saṁhitā*. The work may belong to 6th or 10th Century A. D.³.

The work opens with a eulogy of the author. Rice is then eloquently extolled as the principal source of strength and domestic happiness.

The most remarkable feature of the book is that it considers agriculture as depending merely on rainfall (*vr̥ṣṭimūla-kṛṣihsarva*) and all forms of irrigation resorted in the areas of scanty rainfall are conspicuous by the non-mention in the book. It is suggested that the *Kṛṣi-parasara* described the conditions of Bengal or at least the rice-producing areas of Northern India enjoying plenty of rainfall.⁴

That fields were extensively cultivated in Northern India in the region now called Bengal and many crops, especially paddy, were largely grown from very early times is amply borne out by the various literary references.

- 1) Mauryan Brāhmi Inscription of Mahāsthān (2nd Century B. C.) - the Inscription records the grant of paddy to people.
- 2) *Raghuvamśa* of Kalidasa (5th Century A. D.) IV. 37 (*utkhatapratiropiṭaḥ kalamah*) hints at transplantation of paddy plants.
- 3) Hiuen Tsang's account (Vide Beal's *Buddhist Records. II*, 7th Century A. D.) p. 194 - "the soil is flat and loamy and rich in all kinds of grain-produce", p. 194 - "it is regularly cultivated and is rich in crops".
- 4) *Rāmacarita* of Sandhyākaraṇandin (11th Century A. D. III. 17 refers to various kinds of paddy crop in parts of Bengal.⁵

The Text begins with an eulogy of the author and of agriculture.

प्रजापतिं नमस्कृत्य कृषिकर्मविवेचनम् ।
कृषकाणां हितार्थाय ब्रूते ऋषिपरशरः ॥ 5.

The introducing verse tells us that Sage Paraśara is relating *kṛṣi-karma-vivecanam*. Rice is then eloquently extolled as the principle source of strength and domestic happiness. The influence of planets on agriculture and rainfall is dwelt upon in some detail. Then the clouds have been divided into four types viz. *Āvarta*, *Saṁvarta*, *Puṣkara* and *Droṇa* and effect of each is described.

एकदेशेन चावर्तः संवर्तः सर्वतो जलम् ।
पुष्करे दुष्करं वारि द्रोणे बहुजला मही ॥ 7

Āvarta is confined to a particular locality, under *Saṁvarta* there is water everywhere, under *Puṣkara* water is scarce and under *Droṇa* the earth has abundant water.

Next we find detailed and interesting methods of ascertaining the annual rainfall, the practical value of such meteorological forecasts has, of course, got to be tested. These are followed by an enumeration of the indications of immediate rainfall, such as, the rising of ants from their holes with eggs, sudden croaking of frogs etc., as well as a statement of particular position of the sun, the moon and the planets effecting rainfall.⁸

Regarding the position of planets and the indication of drought the work observes: Mars causes immediate draught while passing on to (the Nakshatras) Uttara-Phāluni, Uttarāṣāḍhā, Uttarābhādrapadā, Śravaṇa, Hastā, Mūlā, Jyeṣṭhā, Kṛttikā and Maghā.

The sun at the back of Mars, dries up even the ocean. It is he who, being in the reverse position submerges even mountains.

Venus being in Citro causes immediate rainfall. Mars being in Leo, the earth becomes full of embers. He, indeed, in conjunction with the sun, dries up even the ocean⁹.

Paraśara versed in the lore of agriculture held that agriculture when supervised yields gold, when not supervised, indeed causes poverty.

“फलत्यवेक्षिता स्वर्णं दैन्यं सैवानवेक्षिता।

कृषिः कृषिपुरुषेण इत्युवाच परशरः ॥¹⁰.

Agriculture, cows, commercial knowledge, women of royal family - these are impaired in a trice through a moment's lack of supervision.

कृषिर्गावो वणिग्विद्या स्त्रियो राजकुलानि च।

क्षणेतैकेत सीदन्ति मुहूर्तमनवेक्षणात् ॥¹¹.

The work maintains that agriculture should be undertaken by a capable person wishing welfare of the people, because an incompetent cultivator resorts to begging.

“गोहितः क्षेत्रगामी च कालज्ञो बीजतत्परः।

वितन्द्रः सर्वशस्याढ्यः कृषको नावसीदति ॥¹².

A farmer doing good to cows, regularly going to fields, knowing the proper season, mindful of seeds, free from lethargy (becomes rich) with all crops and does not suffer.

Bulls are an essential element in agricultural operations, as such great care of and humane treatment to them have been strongly ordained.

कृषिं च तादृशी कुर्याद्यथा वाहान्न पीडयेत्।

वाहपीडाजितं शस्य गहितं सर्वं कर्मसु ॥

वाहपीडाजितं शस्य फलितं च चतुर्गुणम्।

वाहनिस्वासवातेन तद्भूतं च विनश्यन्ति ॥¹³.

Carry on cultivation in such a manner so that it does not inflict pain on the drought animals. Grains obtained by the suffering of drought animals are condemned in all the rites. Corns, obtained through oppression of drought animals. Though grown four-fold, are quickly destroyed by their sighs.

Certain rites e.g., those to be performed in Laguda-pratipat in the month of Kartika, are enjoined as they are supposed to be conducive to the health of cattle. Regarding the number of bulls to be employed, eight is the best and two is the worst. One who wishes constant favour of the Goddess of

Wealth should use ten ploughs. The possession of a single plough is most vehemently condemned¹⁴.

Cowdung as a manure has been highly extolled to the point of veneration¹⁵.

Parāśara notes; The soil is like gold in Māgha, silver in Phālguna, copper in Chaitra and like the paddy in Vaiśākha.

Gold is cultivated in dewy season (*hemanta*), copper and silver in (*Vasanta*) and paddy in summer (*nidāgha*) at the advent of rains.

हेमन्ते कृष्यते हेम वसन्ते ताप्ररुप्यकम् ।
धान्यं निदाघकाले तु दारिद्र्यं तु घनागमे ॥¹⁶

Nala-ropana forms an important part of the cultivator's work. It consists in fixing, at the prescribed time, the plant called *nala* (reed) with leaves at the north-east corner of the field. This is to be accompanied by the worship of paddy plants. This *nala* is supposed to avert all evils to the paddy. The practice of fixing poles of various designs in the fields in order to scare mischievous birds and beasts still prevails in Bengal and a large part of India¹⁷.

Before harvesting the crops, the owner of the paddy field must observe the rite called *muṣṭigrahaṇa* on an auspicious day in the month of Agra-hāyaṇa.¹⁸

The ceremony called *Puṣyayatra* to be performed when the harvesting is not yet over. In this ceremony there should be worship of Indra and a sumptuous feast with kinsmen of the owner consisting of various delicacies kept on banana leaves (*kadal dala*) the principal item being new rice (*navānna*)¹⁹.

The stage following the harvest is *mardana* or separating the grains from the stalks. The grains of paddy should be weighed by standard weights. (प्रमाणेन तु मापयेत्)

The last thing is to be done is the *Lakṣmī Pūjā* (Worship of the Goddess of Wealth)²⁰.

The rites and ceremonies, associated with the various agricultural operations, may lead the modern agriculturist, with a bent of scientific mind to see the work as a priestly manual

adding to the widespread sacerdotalism of ancient India. It has been rightly pointed out in the introduction that religious practices were closely interwoven in the texture of life of the ancient Indian so that even such practicae things as agriculture could not escape the agricultural rites.

The book undoubtedly contains very valuable information regarding the important business of agriculture. The instructions, shorn out of the superstitious matters the speculative astronomical observations and the religious practices, cannot fail to impress us even to-day²¹.

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3. *Op cit*, Introduction, p.IX
4. *Ibid*, p.X.
5. *Ibid*, p.XI
6. *Ibid*, p.1, No.1
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14. *Op cit*, Introduction, p.XIII
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Agriculture As Depicted In Kautilīya Arthaśāstra

MEENAL PARANJAPE

It is a very wellknown fact that *Arthaśśtra* of Kautilya is an important work on political economy and administration. As this work deals with all the aspects of governance one naturally comes across many principles regarding agriculture. These principles and directives are of two kinds: (a) The role of the state in the development of agriculture. This includes- (i) Various rules and directives given to the ruler to encourage agriculture among the farmers and cultivators who are either owners of the land or lease-holders. (ii) Various incentives given to them by the state. (iii) State activity related to the development of water sources. (iv) Administrative officers and their related functions. (b) State owned lands which were brought under cultivation by *sitādhyakṣa* who was the officer in charge of this activity.

Another important aspect in agriculture is not just the method of cultivation, using natural manure, development of various water resources but also getting right price for the produce so that the cultivator and the buyer both are satisfied; various taxes are imposed on cultivators and assistance is given to cultivators at the time of natral calamity. In *Kautilīyya Arthaśāstra*

all the above-mentioned points are discussed as agriculture was the prime factor in the economy. In this paper an attempt is being made to get a glimpse of the condition of agriculture and its importance in the state economy. Here it is already assumed that the work *Kauṭīya Arthaśāstra* belongs to about 321 B. C. as accepted by most of the scholars.

As rightly pointed out by Prof. K. T. Shah, "A close study of our ancient writers will not fail to reveal their profound appreciation of the problem of food and population, long before Malthus touched off his pessimistic note on the evils of excessive population¹. In book II Kautilya describes in detail how colonisation should be done systematically. Here also one comes across special directives given by Kautilya. Even though given in the book on colonisation, these directives appear to be applicable and relevant to all the countries.

It is important to note that Kautilya proposed that the villages to be settled should consist mostly of *sūdra* agriculturists. Thus agriculturists were encouraged and he also further points out that a village should constitute minimum of one hundred families and a maximum of five hundred families².

This shows that Kautilya was careful about the fact that the population should not overstrip the primary source of food supply.

The land in village was supposed to be distributed as follows. Some of the land was to be given as grants to priests, preceptors, chaplains and Brāhmins learned in the Vedas as gifts to Bhahmins which was exempt from fines and taxes, with rights of inheritance passing on to thier heirs or successors.

It cannot be said that this simply meant that Kautilya was partial to Brāhmins. First of all it did not necessarily mean that land given to them was very productive as in a later section Kautilya points out that "The land unsuitable for agriculture besides allotting to pastures, was to be granted to ascetics—those engaged in the study of the Vedas and *soma*-sacrifices with safety promised to (everything) immovable and movable in them, one '*goruta*' in extent at the most."³

These Brāhmanaṅas also discharged important functions by teaching the Vedas etc., and imparting education.

The heads of the departments, accountants and others *gopas*, *sthānikas*, elephant trainers, physicians, horse trainers and couriers were given lands temporarily without the right of sale or mortgages.⁴

It was necessary for the Government to settle these officials as they were to look after administrative and defence side of the village. But it was equally important to check that they would not misuse the land given to them; they could not pass it on to the next generation; neither could they sell or mortgage it for monetary purposes. They paid taxes in kind.

But in contrast to them, the tax payers were allotted 'arable fields for life'.⁵

The other farmers who were trying to make unarable land arable were allowed to do so and the land was not taken away from them.

It is, however, very important to note that the ruler was supposed to take away land from those who did not till them and could give them to others who would till them.⁷

This rule is very important as it saved a common till from going into the clutches of Government Officers or feudal lords.

This illustrates that Kautilya was very much concerned and desired that no land with productive capacity should be wasted. This is one of the important principles with reference to agricultural land and its proper use for the sake of revenue of the State.

The following incentives and concessions were given to the people engaged in agriculture:

- a) The farmers were to be provided with grains, cattle, and money, which they could pay back afterwards at their convenience.
- b) Exemptions from the taxes were granted at the time of settlement.
- c) Irrigation works were to be undertaken with natural water resources or artificial sources to be brought in from elsewhere or the ruler was also to help the farmers who

were doing their work in the land routes and planting of trees or manufacturing of implements etc.

d) Agriculture was to be protected from oppression by the levy of fines, labourers and taxes and herds of cattle (oppressed) by thieves, wild animals, poison and crocodiles as well as by diseases.⁸

e) The region laid waste by the army of any enemy or by foresters, or afflicted by disease or famine was exempted from payment of taxes.⁹

Methods of Agriculture

Even though one comes to know these methods from the section describing functions of *sitādhyakṣa* it is equally possible that similar methods were used on private lands, even though in the section of *sitādhyakṣa* all these methods are mentioned. The section begins with qualifications expected for *sitādhyakṣa* or list of qualified persons he was to employ. "Sitādhyakṣa himself conversant with practices of agriculture, शुल्बशास्त्र or tapping underground water sources and the science of rearing plants or assisted by experts in these fields should carry out all the agricultural work."

The terms कृषितन्त्र, शुल्ब, वृक्षायुर्वेद mentioned here are highly significant. These terms show that there was a specific technique of agriculture, not only that the methods to tap underground water sources were developed and also the term वृक्षायुर्वेद refers to science of rearing plants. This shows that at that time for agriculture people did not just depend upon whatever natural resources were available but tried to improve upon them, observed them and experimented upon them.¹⁰

Next important point that is mentioned is about rainfall. In 2.24.5 & 6, it is mentioned 16 *droṇas* is the quantum of rain in dry lands, one and half time, of (that) in wet lands, where sowings are in conformity with the nature of the season, 13 *droṇas* and half in *aśmakas*, 23 in *avāntis*, unlimited in the *aparāntas* and the snowy regions and (unlimited) as to time in lands where sowings are made with the help of canals. These lines indicate that measurement of rain and rain gauge was very well known. In 2.5.7., while describing the work of सन्निधाता it is clearly mentioned 'कोष्ठागारे वर्षमानमरत्निमुखं कुंडं स्थापयेत् ॥'

In the magazine he should place a basin with a mouth one *aratni* (in width) as a rain gauge.

According to it gauge is square, each side being one cubit. The *Bṛhat Saṃhitā* (23.2) also refers to हस्तविशाला कुंडका adding that it should measure 1 *Ādhak* of rain and that the capacity of vessel should be one *drona*, for rain is measured in *drona*.

On the basis of 511 cubic inches in a *drona* and a cylindrical rain gauge with a surface area of about 254.3 sq. inches (1 *aratni* about 18 cm.) diameter, 16 *dronas* = 32 inches of rainfall & if the gauge mouth is understood to be square, 18" X 18" they rain would amount up to 25".

It appears that Kauṭīliya was fully aware of the distribution of rainfall on the vast territory. This also shows that these observations and checking and rechecking of the judgements must have been done after a long observation.

In *Arthaśāstra* it is also mentioned further when a season is considered to be good.

According to commentators, monsoon was considered spread over for four months - *śrāvaṇa* to *Kārtika*.

In 2.24.6 it is mentioned that 1/3 rd of rainfall in first & last months together, and 2/3 rds in the intervening two months, were considered as excellent season.

Astronomical observations were also advised. Position and motion of Jupiter, rising and setting of Venus and modification in the natural appearance of Sun were observed. It is mentioned that successful sprouting of seeds is known from Sun, from Jupiter formation of stalks in the crops, from Venus rain. However how to observe these and how to arrive at a proper judgement is not mentioned anywhere.¹²

Continuous rains for 7 days, 80 days showering drops of rain and 60 days intermittent showers alternating with sunshine. This rain-fall according to Kauṭīliya is even & beneficial.

Sitādhyakṣa was advised to decide on the crops to be sown according to the requirements and availability of water whether plenty or little.

Sali-rice, (त्रीहि, कोद्रव) Priyangu, उद्रक, वरक are first to be sown Mudga (मूग) Māṣa (उडीद) blackgram śaimbya are middle sowings. Safflower, lentils, Kulīth, barley, wheat, linseed, mustard are sown last.

Śali and other such types of grains are considered as best crops, vegetable middling, sugar-cane worst. (Sugarcane according *Arthaśāstra* is fraught with many dangers and requires much expenditure. According to the availability of water, wet crops, winter crops and summer crops were decided. Not only the availability of water is considered but we also find thought given to the type of soil. For e. g., it is said that region where the foam strikes (the banks) is (फेनाघात) suited for creeper fruits, (regions) on outskirts of overfolw (परीवाहन्ता) are good for long pepper, grapes, sugarcane, the borders of wells good for vegetables and roots, moist beds of lakes are good for green grass, ridges of farms are good for perfume plants, medicinal herbs, Usiragrass, (न्हीबेर, पिंडालुक) and others.

The method of sowing was as follows :

The seeds were soaked in dew by night and dried in heat by day for seven days and nights was the treatment; for seeds of grains, for pulses this same treatment was given for 3 or 5 days. In case of planting of stalks, cut was smeared with honey, ghee, pigfat mixed with cowdung, in case of bulbous roots only ghee & honey were used; only cowdung was smeared on hard stone like seeds; in case of trees, pits were dug and grass and leaves were burnt in pits and filled with cowbones and cow dung at proper time. When they sprouted they were given manure with fresh acrid fish along with milk of Shouhi plant.

Rites & rituals at the time of sowing the seeds were simple.

First the seeds were immersed in water containing gold and the following *mantra* was recited.

प्रजापते काश्यपाय देवाय च नमः सदा।

सीता मे ऋष्यतां देवी बीजेषु च धनेषु च॥

It is, however, interesting to note that those learned in the *Vedas*, *śrotriyas* and *tapasvis* or ascetics were directed to take only those flowers and fruits that were fallen on the ground for worship of Gods, rice and barley for *agrāyaṇa* sacrifice.

At the time of harvest, to avoid the danger of fire, it is specifically mentioned that workers were not allowed to carry fire on the threshing ground and water was to be provided all the time on the threshing ground.

Sheds in which the grain was to be stored was supposed to have high walls and high roofs, with special instructions to make tops neither very compact nor very light.

It is mentioned that best land is *adevamāṭṛka* not depending on the God of Rain, implying plenty of natural resources of water, like rivers, lakes etc.¹⁴ But when there is scarcity of these irrigation was necessary. It was an important activity of state. Two types of *setus* are mentioned *sahodaka*—by natural springs of water, while *aharyodaka* implies storing of water by means of an embankment.¹⁵

The first one was preferred to the second one.¹⁶

Private ownership of irrigation tanks was thought of; one could mortgage the tank. Ownership of tank was lost if it was not used for 5 years.

At the time of new settlement every one had to contribute in any manner by paying part expenditure, labour, giving implements and carts for the work of irrigation.¹⁶

For agricultural labourers (both in the farm, fruit, flower and vegetable gardens, wage was fixed one *paṇa* and a quarter per month plus food for them and their families. *Samāharṭṛ* along with his assistants kept full watch on yields and recorded them.¹⁷ *Pradeśṭṛ* collected the dues. There is, however, confusion over taxes to be paid as *bhāga* 1/6th share, *kara*, *daṇḍa*, *balipragraha*.

There is also *udakabhāga*, rate for water consumption.

Panyādhyakṣa was to carry out important functions of fixing prices.¹⁸

Panyādhyakṣa also tried to strike balance by intervening at the time of glut and centralizing the sale of a particular commodity so that prices will not slump.

Conclusion

From the points discussed above it is very clear that approach towards agriculture in ancient days was systematic. Proper techniques for tapping the underground water-sources were developed. Natural manures were used. Close observation and to some extent experimentation appears to have been carried out regarding types of soil and rain. Rain gauge was known and utilized. With astronomical observation, attempts appear to have been made for the forecast about rain, and crops. The alternative arrangement, in case the rain failed, was thought of. Therefore, importance was given to irrigation.

The development in agriculture depends a lot on the policy of the State. 2300 years ago as it can be seen that the State had a definite policy for agriculture. This policy has modern features like long term planning and short term planning. Colonisation was mainly done by encouraging agriculturists. All the facilities were given to cultivators by the State such as seeds, tools, etc. Exemption from taxes in early years to the cultivator, and also during famines was thought of. State help was given for irrigation work. Compulsory involvement of people concerned in the irrigation project is a unique feature from which we can learn a lot to-day instead of expecting government to do everything for us.

The State acted as a middleman and tried to strike a balance between traders and buyers; however, how the tax was charged is not very clear.

The overall picture is that Agriculture was a systematic and well planned activity encouraged in all the possible ways by the state.

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4. *Ibid* 2.1.7
5. *Ibid* 2.1
6. *Ibid* 2.1

Agriculture In Kauṭīliya Arthaśāstra /

- 7 *Ibid* 2.1
- 8 *Ibid* 2.1
- 9 *Ibid* 2.1
- 10 *Ibid* 2.24.1
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- 12 *Ibid* 23.2
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- 14 *Ibid* 6.18
- 15 *Ibid* 2.1.20
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Some Common Agricultural Ceremonies and Rites in Manipuri Life.

Dr. M. KRITI SINGH

Being an agricultural country, agricultural rites with special reference to rice production, harvest, rainfall and drought, formed an essential part of the life of the Manipuri people. The land was blessed with crops which nourished the people. Some relatively common popular rites and ceremonies are described here to illustrate this point further. In urbanised and modern life-styles some critics of the folk way life, hold that emphasis on magical rites is not dependable.

The paper shows the rites connected with agriculture as the basic requirement of their life.

Phaoibi Khurumba (Worship of rice-goddess)

Lores/ legends (later reduced to writing) are abundant in Manipuri language regarding *Phaoibi* (corn Goddess), the presiding deity of agriculture. We have folk songs or treatises on *Loutraol* (Hymns concerning the first tilling of soil), *Phoukourol* (Summoning the spirit of paddy), *Kotlāi Khurumbā* (adoration of the granary deity), *Phaoibi Wārol* (goddess of

paddy), *Lāngol* (incarnation), etc. The account differentiates between Phaoibi and her seven friends viz, Ngāriimā (deity of fish), Thumleimā (deity of salt), etc. The account also refers to her as the daughter of Almighty Guru (or Sorārāl/Indra) and invokes her as more dramatic than her friends or sisters. Shakespeare, the author of *The Religion of Manipur* remarks of Phaoibi as the spirit of rice and not as an *Umaṅglāi* (forest deity). But the epithet *Umaṅglāi* to whom *Lāiharāoba* festival (annual merry-making ceremony) are dedicated by the villagers is applied to Phaoibi in such concepts as Phouṅgakchāo Phaoibi, Ithai Phaoibi, Arong Phaoibi, etc., which are in several locations of Manipur valley.

The earliest text eulogising Phaoibi as a goddess of beautiful crops is the *Lāngol* (incarnation) in the Chakpā area. The *Moirāṅ Sāyons* (epic lore of Moirang principality) also mentions her as one of the first incarnations and speaks of how, she fell in love with *Moirāṅ Akongjāmbā* the mortal hero and to demonstrate her regard and association of her as a fickle-minded lady changing her dwelling place from one to another is also plausible as she abandoned one area on account of her degradation. Her cult was connected with the *Chakpās* (Scheduled caste) and *Moirāṅ* (one of the classes) in the early stages. Her cult is being adopted among all clans and houses of every agricultural community of Manipur from the kings down to the individual houses.

As per the codes of the Meiteis, ploughing must commence on *Phāirel Panchami* (about January). It is a day sacred to the cultivators. The cultivation by a tenant on this day details the formalities to be observed by the Landlord and tenant with respect to annual rents in paddy due to be got by the Landlord. The tenant cannot be evicted after this.

During the regime of the *Mahārājas*, the people observed a practice in which the Rājā/Ruler was obliged to offer to Phaoibi fruits and vegetables at four corners of a specially prepared piece of land. Besides, there is the practice also of dividing the land into three sections when seed had to be sown. Ploughing the field without reference to the condition of the land is necessary.

The ploughing, sowing of paddy seeds, harvesting, gathering paddy in a granary and worship of the deity in the granary, are observed by the people on sacred days and not on bleeding day and inimical day, according to Pre-Vaiṣṇavite Meitei calendar.

Harvesting Rite

Origin of a grand harvesting rite is traced to the *Puyās* of *rite*; where it is stated that the Maiba has to invoke Phaoibi to increase the rice yield. Shakespear, the Political Agent of Manipur, an eye witness of the elaborate ritual recalled it in his writings, which he translated as the *Mantra* for the English speaking world:- "By the Maibas, the glorious heap of paddy becomes more beautiful. "You from Mayang Khullen, let it increase, let it grow, grow up, let it grow long. On this day of calling all we your grandchildren, offer a black hen to you our Lady Phouoibi addressing you as Loimom Phou. What we have of the cooked rice, let it not decrease but increase. What we leave of the Zu, let it ferment again. O, Lady, I make the paddy to increase on the thrashing mat as the rivers fertilise the land."

People of Pre-Vaiṣṇavite times think that the offering of a black hen and rice beer can activate the function of Phaoibi, thereby accumulating good fortune. In contrast, in the case of the Hinduised Manipur, the elaborate ritual for paddy plant and rich harvest at the expense of the Government was not countenanced since the 18th century.

According to current practice the sacrifice—black hen and rice beer, has been abandoned. Rice mixed with flower or a banana leaf is to be thrown in four directions by the owner of the paddy (after the ritual). It is quite sufficient for this purpose.

An attempt is made to accommodate the results of previous harvest by the *Māibās* of to-day. If the last year's harvest is good the following formula is used: "You gave us good crops last year; we pray you to give us good crop this year." In the case of a poor harvest in the previous year, a different formula is used. It runs as follows. "The last year's crop was

not satisfactory; Let there be plenty this year. Let there be no insects."

It is to be noted that archaic Manipuri language of the incantation and the skill of the Physician/Maiba serve to voice the general sentiment indicative of the need of the community.

Phoukoubā rite (Calling the rice).

The ceremony of calling the rice may be held on the last day of thrashing paddy where the paddy is to be carried to a house for storing. The mode of performance may vary with the time and circumstances. Full ritual style is the privileged task of the Meitei *Māibā* (Medicine man/priest) at the time. When such mishaps as theft of paddy, burning of paddy or passing of a cow trespasser on the thrashing site, it is thought that the rite is carried out to request Her to remain instead of withdrawing on account of the mishaps. Offerings include four poles, bunch of paddy plants, a big mat, white cloth, *Lāngthri* leaves, itishing flower, bunch of banana having odd number, sugarcane, cotton, tobacco, *mudky*, pan, chillies, salt, fan, plantain, flag, bamboo, turban and spade for the cultivator, *Tāiren* leaves, etc.

Important offering must be either fish or *Ngāten* to be cooked with herbs only (without spices) along with rice. The eloquent expression of Phaoibi's greatness is to be found in the recitation of lores placing before us a conception—the goddess of wealth and prosperity—a rite conducted by the *Māibā* with the burning of *Khoiju Lāikham* and *mekruk* (incense).

Kotlāi Khurumbā Rite

Adoration of the Phaoibi in her stone form in the granary is another rite performed in the month of *Wākching* in front of the paddy room by offering materials and *pūja*. It is adopted by the big or small houses with good intentions for Her. It is performed by every member of the household together with other necessary rites, viz worship of dieties of the four directions, ruling deity of the village. The house resounds with the prayer showing her greatness. It goes on to say how the thiklai *Tāōbi*, younger sister of Muba being unable to be satisfied with the boons of abundance of pigs, cows, lands demanded the change

of skin and Iyang Sitpa (to move touching the ground with belly) like the snake. The goddess expresses her inability as she is not a snake or reptile. A compromise was reached in which they made friendship each year and revealed to Muba's sister, the colour of *Lāiphi* (god's garment) in a divinatory process; she was blessed with a good and worthwhile life on the earth and final release hereafter.

Kurāk Lamtäibā

This precultivation seasonal ritual takes place on the first or the third or the fifth day during the month of *Ingā*/June-July in honour of the presiding deities of the North, South, East, the south-west and north-east (Koubru, Thānging, Wāngbren and Mārjing). Offering of wind, owls, pan, fruit, flowers, Lāngthrei leaves, rice, fish etc., are made to them as well as to the rice goddess. Children are fed with these cooked materials. It is also observed widely at the onset of the cultivating season. As a general custom the villagers of a particular *Loi* (Scheduled Caste) community are prohibited from tilling the soil and staying outside the village. The rite is typically *Loi* as it was not observed by the Meiteinised or advanced section of Meitei society. Symbolically it corresponds to *Amu Vāci* where no tilling is done according to the Hindu calendar.

The Vaiṣṇavised Meiteis also continue this rite by altering a little. They surrender such habits as offering of wine, sacrifice of animals. They worship God Puthibā in the same month in order to protect the cattle from the visit of natural calamities. The owner of cattle is not expected to let loose cattle in the village after the celebration of this rite.

Ceremony of driving away the caterpillars

The ceremony is the worship of a certain goddess *Laphurit Leimā Wādagnu Chomkhoidoisibi* said to be the daughter of a *Hāo* (Hill man). This is observed specially at the time when the crops were being attacked by caterpillars. The main ritual, which is common to the hilly and plains people, involves the *puja* by the Pandit *Achoubā* /Head Pandit of the royal palace with the help of tribal people, viz Koms, from Sagang and Tonshem. Functions like the sacrifice of a pig, a cock, an

egg, fish, paddy, molasses, milk, fruits, sweetmeats, the betels and *daksina* along with recitation of *mantras* to drive away the insects are held. The tribals who join the *pūjā* were entertained to the flesh of animals and eggs. The remaining of the offering was divided between the *Māibās* (Priests) and the Manipuris who assisted them. The function was held in *Hiyāngei* (October-November) in honour of *Loulāi* (deity of paddy). This rite was recorded by Shakespeare during the reign of Maharaja Churrepand Singh of Manipur (1892-1940) as an eyewitness. But increasing knowledge of Hindu methods, of sickness and disease, of weather and seasons etc., discredits such ceremonies which were regarded as essential to welfare.

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प्राचीन भारत में मौसम विज्ञान

दुर्गा दुबे

वाणी के वरदपुत्र भारतीय मनीषियों की तीक्ष्ण बुद्धि ने अध्यात्म के धरातल पर सांसारिक जीवों के लिए आत्मबोध एवम् जीवन मृत्यु के बन्धन से मुक्त होने के लिए मोक्ष का मार्ग ही नहीं खोजा प्रत्युत अतीत की कोख में निहित भविष्य के साथ सामंजस्य स्थापित करने हेतु उसे जीवित रखने के सूक्ष्म उपायों को भी अन्वेषित किया। वैदिक साहित्य से लेकर आधुनिक साहित्यों में भी उनके विचार पूर्णतः या अंशतः परिलक्षित होते हैं। भगवान श्रीकृष्ण ने उसी लक्ष्य को इंगित करते हुए कहा -

“अत्राद्भवन्ति भूतानि पर्जन्यादन्नसंभवः
यज्ञाद्भवति पर्जन्यो यज्ञः कर्म समुद्भवः। गीता ३.१४

कालिदास का 'शरीरमाद्यं खलु धर्म साधनम्' ¹ तथा उपनिषद् "अन्नं ब्रह्मेति व्यजानात्" ² की ओर स्पष्ट संकेत करता है। आध्यात्मिक शक्ति प्राप्त करने के लिए शरीर का स्वस्थ होना नितान्त आवश्यक है और यह सात्विक आहार से ही संभव है।

अद्यतन वैज्ञानिक युग में आहार प्राप्त करने के अनेक भौतिक साधन उपलब्ध हैं। इनकी भौतिकता ने जड़ से चेतन तक को भौतिक वादी बना दिया, परिणामतः आध्यात्मिकता लुप्तप्राय सी हो गई है। प्राचीन भारतीय वैज्ञानिकों ने अध्यात्म का प्राश्रय लिया था, अस्तु आध्यात्मिकता ने सबको समाहित कर लिया। जिन जिन वस्तुओं के संयोग से नई वस्तु का निर्माण होता है, नव निर्मित वस्तु में किसी न किसी रूप में उसके गुण अवश्य

विद्यमान रहते हैं। हाँ यदि कहीं कोई अपवाद दिख जाय तो बात और है, क्योंकि अपवाद तो अपवाद ही होते हैं। जैसा आहार होता है वैसी ही बुद्धि होती है, इसीलिए हमारे महापुरुषों ने सात्विक आहार पर विशेष बल दिया है। सब, रज, तम के आधार पर तीन प्रकार के आहार तथा उनके लक्षण और गुणों का वर्णन गीता के १७ वें अध्याय में किया गया है।

आयुःसत्त्वबलारोग्य सुखप्रति विवर्धनाः।

रस्याः सिग्धाः स्थिरा हृदया आहाराः सात्विकप्रियाः॥१७.८॥

कटुम्लरसलवणात्युष्णतीक्ष्णरक्षविदाहिनः।

आहारा राजस्येष्टा दुःखशोकामयप्रदाः॥१७.९॥

यातयामं गतरसं पूति पर्युषितं च यदा।

उच्छिष्टमपि चामेध्यं भोजनं तामसप्रियम्॥१७.१०॥

अन्न खेतों में पैदा होता है और यह बिना वर्षा के संभव नहीं है। वषट्क आधार पर ही 'रब्बी' और 'खरीफ' दो प्रकार की फसलें भारत में होती है। 'रब्बी' की फसल नरसात के मौसम में होती है जैसे धान, मक्का, अरहरआदि तथा 'खरीफ' की फसल बरसात के बाद जैसे गेहूँ, चना, मटर आदि। कुछ फलों तथा सब्जियों की खेती 'खरीफ' के बाद गर्मी के मौसम में की जाती है - जैसे ककड़ी, खरबूजा, कूम्भांड आदि इसे 'जायद' कहते हैं।

ऋतु - भारत प्राक्तन काल से ही कृषि प्रधान रहा है। कृषि ऋतुओं पर आधारित है। वेदों में ६ ऋतुओं का वर्णन मिलता है।

वसन्त इवु रत्यो ग्रीष्म इवु रत्यः।

वर्षाण्यनु शरदो हेमन्तः शिशिर इवु रत्यः ॥ साम. ३.६१६

“हे अग्ने परमेश्वर आपकी कृपा से वसन्त ऋतु रमणीय हो और ग्रीष्म, वर्षा, शरद, हेमन्त और निरचय शिशिर ऋतु रमणीय हो।” ऋतु नक्षत्रों पर आधारित हैं। दो दो महीने की एक ऋतु होती है। तैत्तिरीय संहिता में ऋतुओं और महीनों के जो नाम दिए गए हैं, उनमें ऋतुएं आज भी वही हैं किन्तु महीनों के नाम बदल गए हैं।

ऋतु	प्राचीन मास	आधुनिक मास
वसन्त	मघु और माघव	चैत्र और वैशाख
ग्रीष्म	शुक्र और शुचि	ज्येष्ठ, आषाढ
वर्षा	नभस् और नभस्य	श्रावण, भाद्रपद
शरद	उष और ऊर्ज	आश्विन, कार्तिक
हेमन्त	सहस और सहस्य	मार्गशीर्ष, पौष
शिशिर	तपस और तपस्य	माघ, फाल्गुन

वैदिक काल में ऋतुओं की गणना वर्षा ऋतु से होती थी और वर्षा का प्रारंभ आषाढ से माना जाता था। कालिदास के 'आषाढस्य प्रथम दिवसे मेघमाश्लिष्टसानुं⁵ से प्रतीत होता है कि वर्षा का प्रारंभ आषाढ के प्रथम दिन से ही हो जाता था। कालान्तर में इनकी गणना वसन्त ऋतु एवम् चैत्र मास से होने लगी। अभिधानचिन्तामणि में मार्गशीर्ष का एक नाम वत्सरादि भी दिया है - "वत्सरादिमार्गशीर्षः सहः सहाः आग्रहायणिकश्च"⁶ से ज्ञात होता है कि कोशकार श्री हेमचन्द्रचार्य (विक्रम संवत् ११४५) के समय में वर्ष का प्रारंभ मार्गशीर्ष से माना जाता था। संभवतः इसीलिए इन्होंने हेमन्त को प्रथम ऋतु माना है - "द्वौ द्वौ मार्गादिकातूः। हेमन्त प्रसलो रौद्रः"⁷

सूर्य एक राशि पर एक मास तक रहता है, स्पष्ट है कि राशियां नक्षत्रों पर आधारित हैं; अस्तु सूर्य अपनी यात्रा नक्षत्रों से होता हुआ पूर्ण करता है। मीन राशि से सूर्य जब मेष राशि पर संक्रमण करता है तभी मेष संक्रान्ति का पर्व आता है और इसके साथ ही नवीन सौर वर्ष का प्रारंभ होता है। यह सत्य है कि राशियों का चक्र एक वर्ष में पूर्ण होता है फिर भी राशियों का एक चक्र अहोरात्र में भी पूजा होता है, वैसे ही जैसे पृथ्वी को सूर्य की परिक्रमा करने में एक वर्ष लगता है, साथ ही वह सूर्य के सामने भी अपनी धूरी पर एक चक्र पूरा कर लेती है जिससे दिन रात बनते हैं। इसी प्रकार नक्षत्रों का भी एक चक्र महीने में तथा एक चक्र वर्ष में पूर्ण होता है।

पूर्वमेघ

प्राचीन काल में मौसमविज्ञान काफी विकसित हो चुका था। महर्षि गर्ग, पराशर, कश्यप, ऋषिपुत्र, सिद्धसेन, बादरायण, असित और देवल आदि ने इस क्षेत्र में उल्लेखनीय कार्य किया है। प्राचीन मौसम वैज्ञानिकों के अनुसार एक कुशल ज्योतिर्विद, जिसने अहर्निश तत्परता के साथ तारामंडल, वातचक्र तथा बादलों के बनने का सूक्ष्म अध्ययन किया है, मौसम के सम्बन्ध में उसके द्वारा की गई भविष्यवाणी कभी असत्य नहीं हो सकती। मानसून(monsoon) का प्रारंभ मार्गशीर्ष शुक्लपक्ष प्रतिपदा के दिन पूर्वाषाढ नक्षत्र पर चन्द्रमा के आ जाने पर होता है। सिद्धसेन कार्तिक शुक्ल पक्ष की पूर्णिमा के बाद ही मानसून का प्रारंभ मानते हैं, किन्तु अन्य विद्वान इसका पक्ष में नहीं है। वे मार्गशीर्ष शुक्ल पक्ष की प्रतिपदा के पूर्वाषाढ को ही बादलों के गर्भ धारण करने का समय सुनिश्चित करते हैं।

मार्गशीरः सितपक्षप्रतिपत्प्रभृति क्षपाकरेऽषाढाम्।

पूर्वा वा समुपगते गर्भाणां लक्षणं ज्ञेयम्॥⁸

पूर्ण गर्भ के ५ निमित्त हैं-वायु, जल, प्रकाश, ध्वनि और बाष्प। प्राचीन मौसम विज्ञान के अनुसार यह अपेक्षा की जाती है कि बादलों के गर्भ धारण के १९५ वें दिन अच्छी वर्षा होगी।

यत्रक्षत्रमुपगते गर्भश्चन्द्र भवेत्स चन्द्रवशात्
पंचनवते दिनशते तत्रैव प्रसवमायाति ॥⁹

यदि पूर्णकाय भ्रूण पाँचो लक्षणों से युक्त है तो वर्षा ऋतु में १ द्रोण वर्षा होती है। वायु से ३ आढ़क, प्रकाश से ६ आढ़क, बाष्प से ९ आढ़क और ध्वनि से १२ आढ़क वर्षा होती है। (१ द्रोण = २०० पल, १ आढ़क = १/४ द्रोण)

पराशर के अनुसार आढ़क एक ऐसे वर्तुल पात्र की क्षमता है जिसका व्यास २० अंगुल और गहराई ८ अंगुल है।¹⁰

मार्गशीर्ष, पौष, माघ, फाल्गुन, चैत्र, वैशाख में यदि बादलों का बनना प्रारंभ होता है, तो उसके १९५ वें दिन से क्रमशः ८, ६, १६, २४, २०, ३ दिन तक वर्षा होती है। बादलों के बनने और उसके वर्षा रूप में परिणत होने के समय में अनुलोम-प्रतिलोम क्रम पाया जाता है। दिन में बने बादल अपेक्षित समय आने पर रात में बरसते हैं, रात के बादल दिन में। इसी प्रकार शुक्लपक्ष के कृष्णपक्ष में और कृष्णपक्ष के शुक्लपक्ष में। इसी तरह पूर्णिमा-अमावास्या अमावास्या-पूर्णिमा, प्रातः सायम्, सायम्-प्रातः।

मार्गशीर्ष और पौष शुक्लपक्ष के बादल मन्द फल देते हैं। पौष कृष्णपक्ष के बादल श्रावण शुक्लपक्ष, माघ शुक्लपक्ष के श्रावण कृष्णपक्ष, माघ कृष्णपक्ष के भाद्रपद शुक्लपक्ष, फाल्गुन शुक्लपक्ष के भाद्रपद के कृष्णपक्ष में, फाल्गुन कृष्णपक्ष के आश्विन शुक्लपक्ष में, चैत्र शुक्ल एवम कृष्ण पक्ष के क्रमशः अश्विन कृष्णपक्ष और कार्तिक शुक्लपक्ष में बरसते हैं। ज्ञातव्य है कि चान्द्रमास का प्रारंभ चैत्र शुक्लपक्ष से होता है लेकिन उसका कृष्णपक्ष वैशाख कहा जाता है, यह स्थिति उत्तर भारत में दिखाई देती है। बादलों की तरह वायु की दिशा भी विपरीत दिशा में ही फल देती है। जैसे पूर्व से आने वाली हवा से जो बरसात होगी वह पश्चिम में होगी। पश्चिम के पूर्व में, उत्तर के दक्षिण और दक्षिण के उत्तर में, ईशान के नैऋत्य, नैऋत्य के ईशान में, अग्नि के वायव्य और वायव्य के अग्नि कोण में बरसेंगे।

चान्द्रमास में पूर्वाषाढ़, उत्तराषाढ़, पूर्वभाद्रपद, उत्तरभाद्रपद और रोहिणी नक्षत्र पर चन्द्रमा के रहने पर बने हुए बादल अच्छी वर्षा करते हैं। यदि मेष निर्माण के समय चन्द्रमा शतभिषा, आश्लेषा, आर्द्रा, स्वाती या मघा नक्षत्र

पर रहते हैं तो अच्छी बरसात होती हैं। मेघ निर्माण काल में यदि बिना किसी स्पष्ट कारण के अधिक वर्षा होती है तो बने हुए बादल अच्छी वर्षा न करके केवल फुहारा गिराते हैं। जब किन्हीं कारणों से समय पर वर्षा नहीं हो पाती तो मेघ जल ओला के रूप में बरसते हैं। जैसे गाय के थन में अधिक समय तक पड़ा हुआ दूध गाढ़ा हो जाता है उसी प्रकार मेघ जल भी कठोर हो जाते हैं। वायु, जल, प्रकाश, ध्वनि और बाष्प इन पांच निमित्तों के आधार पर बादलों के अनेक भेद होते हैं और उनसे होनेवाली वर्षा का परिणाम भी भिन्न भिन्न होता है।

आधुनिक विज्ञान ने भी उँचाई, वायु की गति आदि के आधार पर बादलों का वर्गीकरण किया है। वर्षा और बादलों के सम्बन्ध में विस्तृत जानकारी प्राप्त करने की आवश्यकता प्रथम विश्वयुद्ध के समय वैमानिकी को निरापद बनाने के सन्दर्भ में महसूस की गई। प्रथम अन्तर्राष्ट्रीय मानसून मानचित्र १८९६ में प्रकाशित किया गया था। उँचाई के आधार पर बादलों के मुख्य तीन वर्ग हैं—

१) उच्चतम - औसत ऊँचाई १६५०० ते ४५००० फूट (५-१३ कि.मी.)

अ) - सिरस (Cirrus) पतले श्वेत तन्तु एवम हिमकणों से युक्त बादल जो लगभग २०००० से ४०००० फूट की ऊँचाई पर स्थित होते हैं।

ब) - सिरोक्युमुलस (Cirrocumulus) ये बादल पतले दानेदार पेऊन (patch) के रूप में होते हैं। इनकी भी स्थिति २०,००० से ४०,००० फुट की ऊँचाई पर होती है।

स) - सिरोस्ट्रेटस (Cirrostratus) हिमकणों से युक्त ऐसे बादल जो प्रायः प्रभामंडल से युक्त होते हैं, इनका रंग सफेद होता है और सामान्यतया इनके उपर तन्तु सदृश पर्दा सा दिखाई देता है। इनकी भी स्थिति अत्युच्च होती है।

२) मध्यम - औसत ऊँचाई ६५०० ते २३००० फूट (२-७ कि.मी.)

क) - अल्टोक्युमुलस (Alto cumulus) गोल अथवा वर्तुलाकार छोटे छोटे बादलों का समूह। इनकी स्थिति लगभग ८००० ते २०००० फुट की ऊँचाई पर होती है।

ख) - अल्टोस्ट्रेटस (Altostratus) भस्म सदृश (Grey colour) बादलों की पर्त।

ग) - निम्बोस्ट्रेटस (Nimbostratus) विकृत गहरे भूरे रंग के बादल

३) निम्नतम - औसत ऊंचाई शून्य से ६५०० फूट (०-२ कि.मी.)

च) - स्ट्रेटोक्यूमुलस (Stratocumulus) घने काले रंग के बादल।

छ) - स्ट्रेटस (Stratus) क्षितिज पर छाए हुए भूरे रंग के बादल।

ज) - क्यूमुलस (Cumulus) ये बादल प्रायः उर्ध्वाकार वस्तुओं जैसे बाष्प, छोटी पहाड़ी, प्रासाद आदि के रूप में दृष्टिगोचर होते हैं। ऐसे बादल प्रायः पर्वतों, घाटियों आदि पर छाए रहते हैं।

झ) - क्यूमुलोनिम्बस (Cumulonimbus) गर्जना करने वाले बादल।

गोस्वामी तुलसीदास के “बरसहिं जलद भूमि नियराएँ” जहाँ यह संकेत देते हैं कि निम्नतम ऊंचाई वाले बादल ही बरसते हैं वहीं यह भी पता चलता है कि गोस्वामी जी को मौसम विज्ञान की भी अच्छी खासी जानकारी थी।

सौर मंडल के ग्रहों का प्रभाव मौसम और पृथ्वी के सभी जीवधारियों की प्रकृति और स्वास्थ्य पर पड़ता है। इस सन्दर्भ में सूर्य की किरणों तथा धूल के आधार पर वराहमिहिर ने आकाश मंडल में समय समय पर पाए जाने वाले अग्रांकित वर्णों का वर्णन किया है। शुक्ल, कल्पाष, बभ्रु, कपिल, विचित्र, मांजिष्ठ, हरित, शबल, पीत, ताग्र, अरुण, धूम्र, भस्म सदृश बन्धूक और कज्जल, मुक्ता, रजन, तमाल पुष्प नील कुमुदिनी, कज्जल के रंग के और जलचर के आकार के बादलों में जल की मात्रा आधिक होती है। सूर्य की किरणों से आतप्त और मन्द वायु से युक्त बादल तूफानी वर्षा करते हैं।

वर्षा

पूर्वाषाढ़ नक्षत्र में ज्येष्ठ मास की पूर्णिमा के दिन वर्षा होने का अनुमान किया जाता है और इसी के आधार पर यह अनुमान लगाया जाता है कि वर्षा कैसी होगी ऋतुओं के प्रारंभ में यदि अपेक्षित वर्षा होती है तो यह अनुमान किया जाता है कि उस नक्षत्र में वर्षा अच्छी होगी। इसी के आधार पर यह भी बताया जाता है कि वर्षा कम होगी या अधिक अथवा सूखा पड़ेगा। वराहमिहिर के अनुसार यदि परिपक्व गर्मधारणकाल में आशातीत जल बरसाते हैं तो नवनिर्मित मेघ अपनी परिपक्वावस्था में केवल फुहारे छोड़ते हैं।

पवनसलिलविद्युद्गर्जिता भ्रामतो यः
 स भवति बहुतोयः पंचरुपाभ्युपेतः।
 विसृजति यदि तोयं गर्भकालेतिभूरि
 प्रसवसमयमित्वा शीकराम्यः करोति ॥ 12

ऋतु के प्रारंभ में प्रथम वर्षा जिस दिन होती है उस दिन के नक्षत्र में तथा उस नक्षत्र के दिन आगे भी प्रायः वर्षा होती है। यदि पूर्वाषाढ़ के प्रारंभ में किसी भी नक्षत्र में वर्षा नहीं होती है तो उस ऋतु में बरसात नहीं होती। हस्त, पूर्वाषाढ़, मृगशिरा, चित्रा और धनिष्ठा में प्रायः १६ द्रोण वर्षा होती है। शतभिषा, ज्येष्ठा और स्वाती में ४ द्रोण, कृत्तिका में १० द्रोण, श्रावण, मघा, अनुराधा, भरणी और मूल में १४ द्रोण, पूर्वाफाल्गुनी में २५ द्रोण, पुनर्वसु में २० द्रोण, विशाखा और उत्तराषाढ़ में २० द्रोण, और अश्लेषा में १३ द्रोण, उत्तरभाद्रा, उत्तराफाल्गुनी और रोहिणी में २५ द्रोण, पूर्वाभाद्रा और पुष्य में १५ द्रोण, अश्विनी में १२ द्रोण, और आर्द्रा में १८ द्रोण वर्षा होती है। वर्षा का यह परिमाण उस स्थिति में ही संभव है जबकि मेघ किसी भी प्रकार की प्राकृतिक आपदा से रहित हो। ध्यातव्य हैं कि जहाँ पर वर्षा का आधार मेघ निर्माण के पाँचों निमित्तों पर आधारित है वहीं वे सौर मंडल के ग्रहों और नक्षत्रों से भी प्रभावित होते हैं।

खेती के लिए कितना जल आवश्यक है, इस सन्दर्भ में आचार्य कौटिल्य का कहना है - रेतीली जमीन में फसल बोने के लिए १६ द्रोण पानी आवश्यक है। इसी प्रकार जल बरसने वाले प्रदेशों के लिए २४ द्रोण, दक्षिणी प्रदेशों के लिए साढ़े १३ द्रोण, मालव प्रदेश के लिए २३ द्रोण, पश्चिमी प्रदेशों के लिए अधिक से अधिक और हिमालय प्रदेशों तथा नहरी प्रान्तों के लिए समय समय का पानी फसल बोने के लिए उचित है। “वर्षात्रिभागः पूर्वपश्चिम मासयोः, द्वौ त्रिभागौ मध्यमयोः सुषमारुपम् ॥”¹³ अर्थात् बारिश के अनुपात से यदि एक हिस्सा श्रावण-कार्तिक में और दो हिस्सा भाद्रपद-आश्विन में पानी बरसे तो वह वर्ष फसल के लिए लाभदायी समझना चाहिए।

वातचक्र

प्राचीन ज्योतिर्विदों ने प्रकृति के नियमों का जितना गहन और सफल अध्ययन किया था आज का विज्ञान उससे बहुत पीछे है। वर्ष में एक दिन किए गए मौसम के पर्यवेक्षण के आधार पर सम्पूर्ण वर्ष का कृषि सम्बन्धि एवम मौसम सम्बन्धि लेखा जोखा प्रस्तुत किया जाता था। यह कार्य आषाढ़ कृष्णपक्ष में रोहिणी नक्षत्र लगने पर किया जाता था। इसकी विधि यह थी कि एक कुशल ज्योतिर्विद नगर से बाहर उत्तर या पूर्व दिशा

में जाकर वहाँ तीन दिन तक मरुत, वरुण की अर्चना करता था। इस अवसर पर सभी ग्रहों एवम नक्षत्रों के साथ विधिवत कलश स्थापन करके महाव्रत मन्त्र से अभिमन्त्रित सभी प्रकार के बीज उसमें रखकर, हवन किया जाता था। तत्पश्चात् समतल भूमि पर बारह हाथ ऊँचे दंड में चार हाथ लम्बा काले रंग के अच्छे सूत से निर्मित ध्वज फहराया जाता था। इस प्रकार के ध्वज का वर्णन कालिदास ने भी अभिज्ञानशाकुन्तलम् में किया है - "दीनाशुकभिव केतोः प्रतिवातनीयममस्य"¹⁴

वर्षा के होने में वायु का भी महत्वपूर्ण स्थान होता है। वायु की गति एवम् दिशा के आधार पर यह आकलन किया जाता है कि वर्षा कब, कित्तर और कैसी? होगी इसके लिए वायु की गति का अध्ययन किया जाता है। बरसात का मौसम चार महीने तक रहता है। चार महीने में आठ पक्ष होते हैं। इनका फलादेश ग्रहों के आधार पर किया जाता है। दिन और रात मिलाकर ८ प्रहर होते हैं। इसका अर्थ यह हुआ कि सभी प्रहर क्रमशः सम्बन्धित पक्षों के सम्बन्ध में सूचना देते हैं। प्रहर के अंश दिन की संख्या बताते हैं। उदाहरणार्थ - कल्पना के लिए दिन के चतुर्थ प्रहर में वायु बही तो चतुर्थ पक्ष अर्थात् भाद्रपद कृष्णपक्ष में वर्षा होगी। इसी प्रकार १ घंटा = ५ दिन, और १२ मिनिट = १ दिन

दक्षिणावर्ति वायु अच्छी वर्षा और अच्छी फसल की सूचना देते हैं। यदि वायु की दशा अनुलोलम प्रतिलोलम हो तो उसमें जो अधिक शक्तिशाली दिशा होगी वही फलीभूत होगी। आधुनिक वैज्ञानिक भी वायु की गति एवम दिशा मायने के लिए ध्वज जैसा यंत्र प्रयोग में लाते हैं।

फसल की पैदावार देखने के लिए आषाढ़ पूर्णिमा के दिन अनेक प्रकार के बीज समान मात्रा में लेकर महाव्रत मन्त्र से अभिमन्त्रित करके रातभर के लिए रख दिए जाते थे। दूसरे दिन तौलने पर जिसका वजन बढ़ जाता था उसके लिए यह माना जाता था कि वर्ष में उसकी पैदावार अच्छी होगी।

अभिज्ञान

प्राकृत काल में भारत ही नहीं प्रत्युत ग्रीक, अमेरिका आदि देशों में भी वायु की गति और दिशा तथा मौसम का सूक्ष्म निरीक्षण करके उसके आधार पर भविष्य में आने वाली स्थितियों, जैसे फसल की पैदावार जाड़ा, गर्मी, बरसात आदि मौसमों के संबंध में लोग भविष्यवाणियाँ करते थे। यद्यपि यह नहीं कहा जा सकता कि उनकी भविष्यवाणियां शत प्रतिशत सच ही

होती थीं, लेकिन अधिकांश अपनी सत्यता को प्रमाणित भी करती थीं। 'Red sky at night shepherd's delight' कहावत को थोड़ी देर के लिए भले ही जुठला दिया जाय लेकिन 'Red at morning shepherd's warning' अपनी सत्यता प्रतिभासित करता है। नाविक और खेतों में काम करने वाले किसान सामान्य व्यक्ति की अपेक्षा प्रकृति से अधिक धुले मिले होते हैं। परिणामतः मौसम के सम्बन्ध में उनका अनुभव किसी वैज्ञानिक तथ्य से कम नहीं होता।

आज के मौसम वैज्ञानिकों द्वारा मौसम के सम्बन्ध में की गई भविष्यवाणियाँ कभी कभी असत्य भी हो जाती हैं, उसी तरह नाविकों एवम् किसानों का अनुमान भी कभी कभी झूठा भले ही पड़ जाता हो, लेकिन उन्हें पूर्णरूप से नकारा नहीं जा सकता। सच तो यह है कि प्रकृति संभवित घटनाओं की सूचना स्वयं ही दे देती है, यह बात और है कि इसे वे लोग ही समझ पाते हैं जो प्रकृति की भाषा से सुपरिचित हैं। मनुष्य की अपेक्षा पशु पक्षी और वनस्पतियाँ भी मौसम के प्रति अधिक सक्रिय दिखाई देती हैं। इस प्रकार के उदाहरणों से साहित्य भरा पड़ा है। पहले लोग पशु पक्षियों की बोली सुनकर समय का अनुमान लगा लेते थे।

“होइहैं नही मुरगा जेहि गाँव, सखी तेहि गाँव का भोर न होइ है”¹⁵

बोली लोमड़ी फूला कास। अब नार्ही बरखा की आस॥¹⁶

इस प्रकार पशु पक्षियों की बोली, उनके बोलने का ढंग तथा उनकी गतिविधियोंको देखकर लोग मौसम के सम्बन्ध में अनुमान लगाते थे और उसे निःसन्दिग्ध शब्दों में व्यक्त करते थे। उत्तर पूर्व से सुखद-शीतल-मन्द वायु का बहना, सूर्य-चन्द्र का प्रभामंडल से युक्त होना, उत्तर पूर्व या पूर्व दिशा में सूर्य के विपरीत मुख करके प्रसन्न मुद्रा में खग कुल का चहचहाना या जानवरों का बोलना वर्षा के आगमन का परिचायक है। बिल्ली यदि नाखून से जोर लगाकर ज़मीन खोदने लगे, लोहा आदि पर लगे हुए जंग से मांस या मछली की गंध आने लगे, गलियों में या सड़कों पर बच्चे पुल बनाने लगे तो समझना चाहिए वर्षा शीघ्र होगी। चींटियाँ बिना किसी व्यवधान के अपने अंडे एक स्थान से दूसरे स्थान पर ले जाने लगे, सर्पों के द्वारा वृक्ष झुक जायं गाय या बैल सूर्य की तरफ देखने लगे तो वर्षा जल्दी होती है। यदि कुत्ते घर के छत पर खड़े होकर आकाश की तरफ देखते हुए लगातार भौंकते रहें तो बहुत अधिक वर्षा होती है। पालतू पशु बिना इच्छा के घर से बाहर निकलकर अपने कान और खुर फड़फड़ाने या हिलाने लगे तो वर्षा जल्दी होती है। अगर लताएं आकाश की ओर

बढ़ने लगे, चिड़ियां पानी में नहाने लगे या धूल में लोटने लगे, काड़े मकोड़े घास की पत्तियों के ऊपरी कोर पर बैठें तो शीघ्र वर्षा अपेक्षित होती है।

शिशिर आदि ऋतुओं में प्रातः एवम् सायंकाल आकाश का रंग क्रमशः लाल, पीला, सफेद, विचित्र रक्त-कमल और रक्त वर्ण का होता है। इसके विपरीत रंग अशुभ फल की सूचना देते हैं। कल्मष, बभ्रु, कपिल, विचित्र, मंजिष्ठ, हरित और शबल रंग का आकाश एक सप्ताह के आस पास होने वाली अशुभ घटनाओं की सूचना देता है। वर्षा के पहले पूर्व दिशा का इन्द्रधनुष वृष्टि का सूचक और वर्षा के बाद अवृष्टि का सूचक है, लेकिन पश्चिम दिशा का इन्द्रधनुष प्रत्येक स्थिति में वर्षाका सूचक है।

प्राचीन काल में प्रकृति में होने वाले परिवर्तनों के आधार पर मौसम की जानकारी जिस प्रकार प्रबुद्ध मनीषियों की थी, उसी प्रकार सामान्यकिसान भी अपने अनुभव के आधार पर अनुमान लगाते थे। खेती एवम मौसम के सम्बन्ध में विशेष रूप से कही गई घाघ भड़डरी की कहावतें बड़ी ही प्रचलित हैं। ऋतुओं के सम्बन्ध में उन्होंने कहा है -

चढ़ते बरसे आद्रा उतरे बरसे हस्त

कितने राजा डांडले आनन्द रहे गृहस्थ॥

हस्त बरसे तीन होय शाली, सक्कर मास

हस्त बरसे तीन जाय तिल कोदों, कपास॥

किस मासमें कैसी वर्षा होगी इसकी एक बानगी देखिए -

सावन कैरे प्रथम दिन उगतन दीखै भान

चार महीना बरसै पानी याको है परमाना॥

सूखा पड़ने के सम्बन्ध में भी घाघ की कहावत सुनिए -

सावन शुक्ला सप्तमी उगत जो दीखै भान

या जल मिलि है कूप में या गंगा अस्नान॥²⁷

समावलोकन

जहाँ के मनीषियों ने जीवन और मृत्यु के बंधन से मुक्त होने के लिए मोक्ष का मार्ग दृढ़ निकाला हो, प्रकृति को पराशक्ति बताकर परब्रह्म से उसका तादात्म्य स्थापित किया हो, प्रकृति और मनुष्य के बीच उपास्य-उपासक का सम्बन्ध बताया हो, वहाँ के लोगों द्वारा प्राकृतिक परिवर्तनों तथा सौरमंडल की गतिविधियों के आधार पर मौसम की जानकारी प्राप्त कर लेना कोई आश्चर्य की बात नहीं है। वनस्पतियों, पशुपक्षियों की बोली एवम् उनकी

दिनचर्या में होने वाले परिवर्तनों को देखकर उसका सम्बन्ध प्रकृति के साथ जोड़ना आज के इस वैज्ञानिक युग में भले ही उपहास का विषय बना दिया जाय, लेकिन उनकी यथार्थता को चुनौती नहीं दी जा सकती। आधुनिक विज्ञान भी किसी न किसी रूप में आज भी उन्हें स्वीकार करता है। गुप्त स्थानों, अपराधियों आदि का पता लगाने में कुत्तों की सहायता ली जाती है।

प्राक्तनकाल में मौसम विज्ञान अपने चरमोत्कर्ष पर पहुँच चुका था। अद्यतन काल में मौसम की जानकारी विविध यन्त्रों की सहायता से वायुमंडल में वायु के दबाव का अध्ययन करके प्राप्त की जाती है। यह कहना अनुपयुक्त न होगा, कि प्राचीन मौसम विज्ञान के साथ आधुनिक मौसम विज्ञान को जोड़ दिया जाय तो वह अधिक कारगर सिद्ध होगा।

अस्तु. प्राचीन मौसम विज्ञान का प्रयोग आज भी अपेक्षित है।

पुराणमित्येव न साधु सर्वं न चापि काव्यं नवमित्यवद्यम्।

सन्तः परीक्ष्यान्यतरद्भजन्ते मूढः पप्रत्ययनेयबुद्धिः॥¹⁸

शं न आपोधन्व्याः शभुं सन्त्वनूप्याः

शं नः खनित्रिमा आपः शमु याः कुम्भ आभृताः

शिवा नः सन्तु वार्षिकीः ॥ अथर्व वेद १.६.४॥¹⁹

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Bhagirathavidyā Irrigation Engineering in Ancient India.

JAYANT R. RAMDAS

Shri B. G. Kher, the then Chief Minister of Maharashtra, while inaugurating the "Fourth International Association for Hydraulic Research in Bombay, on 2nd January, 1951, addressed the gathering: "India is essentially an agricultural country and Indians have always fully appreciated the beneficent use of water as is evident from the Vedic prayers and specially from the famous hymn *Āpohiṣṭā*. We have been using artificial irrigation as an aid to agriculture from times immemorial starting from very ancient times. The science of irrigation has developed in this country to its present state of advancement and for us the science of Hydraulics is synonymous with the science of irrigation"².

Shri Kakasaheb Kalelkar used the terminology "*Bhagīrathavidyā*" for Irrigation Engineering in ancient India.

Valmiki has immortalised, the story of Ganga's descent to the earth from the heavens as narrated by sage Viśvāmītra to the young boys Rāma and Lakṣmaṇa first on Śiva's *jaṭā* and therefrom her flow into Bindusaras when released, and

whence she multiplied herself into seven streams—Hlādinī, Pāvanī, Nalinī (eastward bound), Sucakṣu, Sitā Singhu (westward bound) and Alaknaṅdā following the course of Bhagiratha to reach the ocean and the netherworld³.

Irrigation works often of enormous size were undertaken by the beneficent kings as religious and social duty. The most famous of that was of Girnār, the history of which has come down to us. We do not know as to when the great embankment over 100 feet thick has crumbled⁴.

King Rudradamana has left the earliest important inscription in correct Sanskrit, a long panegyric which records his martial exploits and his reconstruction of a great artificial lake at Girnār in Kathiawar which had been excavated under Chandragupta and improved in the time of Ashoka. This inscription is certainly amongst the earliest dated records of ancient India and proves that Rudradamana was reigning in 150 A. D.⁵.

The city governor (according to *Arthaśāstra*) had other more positive duties. He was responsible for the cleanliness of the streets and the prevention of fire. His duties also involved prevention or alleviation of such disasters as famine, flood and plague. Thus the last record we have of the Girnār dam is how it burst and how it was reconstructed by the local city governor Chakrapālita during the reign of Skaṅda Gupta. Chakrapālita, the son of the provincial governor Prāṇadatta is praised in the inscription commemorating the rebuilding of the dam in terms which are indeed panegyric but certain passages are quite unexpected and depict the city governor as a popular figure on the most friendly terms with the citizens. In any case, these verses show the ideal set before the local official in the Gupta times and, therefore, are very significant⁶.

Samarāṅgaṇasūtradhāra is a work on architecture. It means, literally, an architect of human dwellings and deals with the planning of towns and villages, building of houses, halls and palaces as well as machines of various kinds.

The author of the work, as mentioned in it, is Mohanjahiraj Sri Bhojadeva who is probably the same Bhoja of Dhora who ruled over Malwa in the first part of the 11th century A.D.

and to whom many important works are ascribed, such as *Śiṅgaraprakaśa* a work on *alaṅkāra* and *Sarasvatikanṭhābharana* (grammar).

The *samarāṅgana sūtradhāra* is worthy of attention. The word *Sūtradhāra* literally means 'thread bearer' i.e., an architect who takes measurements by means of the plumbline. Here is a pun on the word 'samara' which means both a battlefield and a mortal human being (*Sa. + mara*) destined to die. Thus the title as applied to Bhoja would signify firstly that he was the architect of the fortunes on the battlefield i.e., who planned the strategy of battle leading to victory and secondly who was the architect of human dwellings i.e., civil architecture on an extensive scale. The epithet in its second denotation is a fact of King Bhoja's building activities, who planned cities, palaces temples, educational institutions, and hospitals, wharfs, lakes, ponds, stepwells, pavillions, resting places, roads, graves etc., in a liberal spirit⁷.

Probably the largest of Indian irrigation lakes until recent years was the lake at Bhojpur near Bhopal built in the middle of the 11th Century by Bhoja Pāramāra, the king of Dhara. This too has vanished. The embankment was breached up by the Muslim invaders in the 15th century and has never been restored but it is evident from available traces that the lake originally covered no less than 250 Sq. miles⁸.

Another monument due to the genius of King Bhoja was the Bhoja Sagara in which water was collected from the three enclosing slopes of mountains and stored into a reservoir by building an embankment on the fourth side. The fame of this wonderful lake resounded in popular memory throughout the mediaeval times and has been preserved up to our own times in the Hindi saying: '*Talā to Bhopala Tala aur Sub Talaiya*' i.e., amongst the lakes the foremost is the one called Bhopal Tal or the lake built by King Bhoja, round which was planned the city of Bhopal, the others are mere ponds of water⁹.

The art of building embankments for artificial lakes has reached its perfection in mediaeval India and its greatest example was that planned and erected by Bhoja that was perhaps equalled later on by Rājasamudra lake of king Rājasamudra of Chittor¹⁰.

Ancient Indians were aware of the flowing force of water, its weight and its relative power, the qualities which are chiefly used in hydraulic machines as is evident from the references in the समरांगणसूत्रधार

धारा च जलभारश्च, पयसोभ्रमणं तथा ॥

यथोच्छ्रापो यथाधिक्यं यथा नीरंघ्रतापिच ॥

एवमादीनि कार्यानि जलजानि प्रचक्षते ॥ समरांगण ३१.२९.३०.

When water flows with a force, it conveys things with it or it pushes things coming in its way; when water drops from a height or exerts an impact and when it is pushed from one direction, it reaches in all directions and these are properties of water that are used in water machines. When a thing floats in water, it means that water lifts it up with a pressure equal to its own weight. When turbines and sprouts rotate, it means water reacts on the pipes while getting out at the open ends¹².

संग्रहीतंच दत्तं च पूरितं प्रतिबोदितं ।

जलं बीजत्वमायाति यत्रेषु जलजन्मसु ॥ समरांगण अ. ३१

Water can be stored; it can be supplied; it can be directed or compelled to react and in this way its force can be used in hydraulic machines. Such storage etc., has to be resorted to because the power of water is greater when stored, as it is situated at a higher level, or as it is available in a larger quantity or as it is conveyed in a more water tight tube¹².

Kalhana Rāja tarangīni in his gives us the details of the great engineering operations which were carried out during Avantivarman's reign for the drainage of the valley and its irrigation. These operations were carried out by Avantivarman's skilful engineer Suya. The systematic regulation of the course of the Vitastā, down to the rock-bound gorge where it leaves the Valley largely reducing the extent of the water-locked tracts along the banks of the river and the damage to the crops caused by floods. The construction of new beds for the river at points threatened by inundationbreaches was among the measures designed to achieve the same object. The change thus made at the confluence of the Vitastā and its most important tributary, the Sindhu, can still be clearly traced. It shows like the large scale and the systematic basis of Suyya's regulation.

The result of the latter was a great increase in land available for cultivation and increased protection against disastrous floods, which in Kashmir have ever been the main cause of famines.¹⁴

स्फुरत्तरंगजिह्वाः स बदीर्मागमजिग्रहत् ।

तास्ताः स्वेच्छानुसारेण मांत्रिकः पन्नगीरिव ॥ ५.१०२ ॥

Suyya made the different streams, with their waves which, like the quivering tongues of snakes, move about according to his will, just as a conquerer does with the snakes.

According to Kalhaṇa, Suyya supplemented these measures by equally important improvements in the system of irrigation which is indispensable for the cultivation of rice, the staple produce of Kashmir. The facilities thus secured for cultivation produced a remarkable reduction in the price of rice, the cost of a rice being¹ alleged to have fallen from 200 *Dinaras* to 36 *Dinaras* in consequence¹⁴.

William Willcocks aptly remarks,

“Following the genius of your country, your ancient writers (Vysā in the *Mahābhārata*) described the physical facts they were writing about in spiritual language, but the facts were all the same. Every canal which went southward, whether it has become a river like the Bhāgirathi, or remained a canal like the Mathubhango, was originally a canal. They were lined out and dug fairly parallel to each other. They were spaced apart. I remember quite well when I began to line out a system of canals for the irrigation of the country, I was astonished to find everywhere that a so-called ‘dead river’ on the map was just where a canal should be placed¹⁶.”

Dr. Buchanan testifies to the irrigation works of the Hindus. He notes.

“At Condataru I saw one of those Hindu irrigation works for which south India was always famous. It was a large reservoir formed by shutting up with an artificial bank in an opening between two natural ridges of ground. The sheet of water was seven or eight miles in length and three miles in width

and was let out in numerous small canals to irrigate fields in the dry season. In the rains it was replenished by the river; there were sluices at different places twenty or thirty feet wide, and these sluices were fortified by stones placed in a sloping direction, to let out the superfluous water. The reservoir could irrigate the lands of thirty two villages during a drought of eighteen months. In a country liable to famines from want of rains, a reservoir such as this is of inestimable value"¹⁶.

Dr. Buchanan also refers to another reservoir in his journal: "On my way to Arcot I saw another splendid Hindu reservoir called the Kaveri Pak. The reservoir is about eight miles long and three miles broad and fertilises a considerable extent of country. I never viewed a public work with more satisfaction, a work that supplies a great body of people with every comfort which their mortal satisfaction will permit them to enjoy"¹⁷.

It is well known that the Egyptian irrigation is founded on Indian practices¹⁸.

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4. Basham A. L. *The Wonder That Was India*, 1954 p.192.
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140 / Agriculture in Ancient India

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15. *Śilpa Sansāra*, Feb. 1955 p. 133.
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“Parjanya” The Mechanical Water Machine- An Exposition

DR SUDARSHAN KUMAR SHARMA

In this critical comments regarding ‘Parjanya’ Dr³ A. A. Macdonell remarks:

“This duty occupies quite a subordinate position, being celebrated in only three hymns. His name often means ‘Rain Cloud’ in the literal sense; but in most passages it represents the personification, the cloud then becoming an under, a pail, or water skin. *Parjanya* is frequently described as a bull that quickens the plants and the earth. The shedding of rain is his most prominent characteristic. He flies around with a watery Car, and loosens the water skin, he sheds rain water as our divine (*asura*) father. In this activity he is associated with thunder and lightning. He also produces fertility in cows, mares and women. He is several times referred to as father. By implication his wife is the earth, and he is once called the son of *dyaus*”.

Dr. Dev Raj Chanana⁴ takes *Parjanya* as a synonym for 'Sky' in the Vedas. According to Dr. Chanana in *Atharva Veda (AV) bhūmi* is called the *patni* of *Parjanya*. *Parjanya* is the presiding deity of cloud and rain⁵, or the rain cloud⁶. Dr. Hari Datt Shastri⁷ also takes *Parjanya* to mean 'a cloud showering forth rain, a water skin (drti).'

*Rgveda*⁸ V 83; VII 101, 102, 103 are entirely devoted to the invocation of '*Parjanya*'. This god is also referred to as such in *Rgveda* VII 102.5⁹; VI.75 15B¹⁰, IX. 113.3¹¹; *Yajurveda Vājasneyi Samhitā* (VS) XXXVI-10¹² *Taittiriya Samhitā* III. 5.8.1 (Ts)¹³ *Atharvaveda (AV)* I.2.1; IV 15.4 X.106-7; XII.1.42;¹⁴.

Madhusudan Mishra¹⁵, while dealing with the 'Etymology of '*Parjanya*' (Rain Cloud) in *Viśveśvarānanda Indological Journal* Vol. XIV Pt. 1. March 1976 pp. 5-6 remarks:

"The etymology of *Parjanya* 'Rain cloud' has so far remained obscure. It is not clear which root Macdonel postulated to explain it when he said that it means (rain cloud') in the literal sense. Of course, its epithets '*Vṛṣabha*' literally 'Sprayer' and '*vṛṣṇyavan*' the possessive form of *vṛṣṇya* 'the *bhāva* or *karman* of *vṛṣan*' 'Sprayer' - contain the root *Vṛṣ* - 'to rain' -to spray, which at least suggests that even the radical element in '*Parjanya*' could have the meaning 'to rain'. But the primary problem is what may be the root inherent in '*Parjanya*', on the face value of it? Professor Mishra derives '*Parjanya*' from '*Parjan*' presupposing *Prj/Parj*. Quoting Benfey, Bohtling, K and rain deriving *parjanya* from '*sphūrj*' and '*pari-janya*' (on the analogy of *parisad* or *par-sad*-assembly) he remarks that Benfey, Bohtling, K and Roth were all embarrassed by the phonetic difficulty. Analysing the root '*sphūrj*' and tracing it back to its original form he calls it a hyper Sanskritised form of the Prākṛt root (Phnujj → spurj → sprj.) He calculates the difference between '*prj*' and '*sprj*' in having an extension in *sprj* at the beginning. He obviously traces the development of '*sphūrj*' from '*prj*'. And from the association of thundering with raining, he assumes that '*prj*' means (to rain) pour down. *Prj/parj* the guttural variant of '*prj*' may explain the formation of *phalingā*⁶ (meaning encompassing, leather bag any- thing

to hold liquid - a receptacle of water, a water jar. *Phariga*, or *parigha*- in which the water is poured down. This suggests *Prj(g)* associated with pouring down as meaning. *Prj(g)* he takes as the extended form of *Prj* having the word 'Pura' flood, a stream and concludes that '*Prj*' definitely means to rain, 'to pour down' '*Parjan*' definitely means 'Pouring down (an action noun). *Parjanya* he takes to be a nominalised adjective, one connected with pouring down i.e., the rain cloud.

¹⁸Yāska in *Nirukta* X.10. gives the etymology of *Parjanya* as under.

'Parjanyastrpeḥ ādyantaviparītasya tarpayti janyaḥ. Paro jetā vā paro janayitāvā. Prārjayitā vā, rasanām. tasyaiṣā bhavati.

*'Vi vṛ-kṣān hantiyuta hantiraksaso; Viśvaṃ vibhāya bhuvanān mahāvadhāt. Utā nāgānīṣate vṛṣṇyavato. Yat parjanyaḥ stanayanhanti duṣkṛtaḥ. Vihantivṛkṣān vihanti ca rakṣāmsi Sarvāṇi Cāsmūdbhūtāni vihyati mahā vadhāt. Mahānhyasya vadhaḥ apyanaparādhō bhītaḥ palāyate. Varṣa karmavato yat parjanyaḥ stanayanhanti duṣkṛtaḥ pāpakṛtaḥ.'*¹⁹ i.e. *parjanyaḥ* (cloud is derived from (the root) *trp* (to be satisfied) by reversing the first and the last (letter); one who gives satisfaction and is favourable to men (*Trp + Janyaḥ = Prt + Janyaḥ = Parj = Janyaḥ = Par + Janyaḥ* - or he is so called (because) he is the best conqueror (*Parah + Jin*) or he is the best progenitor - *Parah + Jan* or he if the bestower of juices (*Pra + rj*). The following stanza is addressed to him.

"He strikes down trees and he strikes down demons, the entire Universe was afraid of the great slaughter²⁰; even the guileless fly from the rain or when *parjanya* thundering strikes the evil doers."

Professor Mishra takes this attempt towards 'its etymology as off the mark.²¹

Peter Peterson²¹ referring to Buhler and Muir quotes the etymology of *parjanya* as given by Bloomfield as *pari* (about) and *Jana* (folk) i.e. guarding the folk through.

Dr. Siddheśvara Varmā²³ in his *Etymologies of Yāska* 'refers' to 'Parjanya' with reference to RV. V. 83.2 and construes this word to mean as derived from *Pra + arj* i.e., One that emits fluids.²⁴ Dr. Sudhir Kumar Gupta in his "*Vaitikabhāṣa Kenairukta adhyayana, Kī Rūparekhā (Yāskīyanirvacave)*" NO.118 re-iterates the etymology of *Parjanya* as given by Yāska.

Dr. Sūrya Kānta²⁵ construes '*Parjanya Krandya*' to mean-rumbling like *Parjanya* (RV. VIII102.5; *Parjanya-Jinvita* (RV.VII 103.1) as impelled or quickened by *Parjanya*; *Parjanya Patni* (AV X.10.6) to mean having *Parjanya* as a husband; *Parjanya retas* - RV VI 75.15 to mean sprung from *Parjanya*; nourished by rain; *Parjanya Vṛddha* (RV. IX.113.3 as nourished by rain. Sir Monier Williams deriving *Parjanya* from (*pr C* or *Prj*) takes it to mean a cloud or a rain cloud. Lexicons such as *Abhidhāna Cintāmaṇi* of Hemachandra²⁷, *Amara kosa* of Amara Siṃha²⁸ and *Medini Kosā*²⁹ illustrate 'Parjanya' among the synonyms of cloud. Hemachandra³⁰ also takes *Parjanya* haryaśvaṛbhukṣi-Bāhudanteyavṛddha. - Śravvasasturāgīl, among the forty two names of Indra.

A review of the texts of the Vedas quoted above along with their exegesis makes it evident that *Parjanya* has been construed in its empirical sense as a synonym of 'Megha'. Even Virendra MuniŚāstrā³¹, a staunch exponent of the symbollic scientific expositions of the Vedic words constructing it as a synonym of 'Megha' translates the verse - '*Vi Vṛ Kṣān hantiyuta*' etc. as under:

"This *Parjanya* destroys the trees by having struck them with thunderbolt (or lightning). It annihilates the demons. The world fears this mighty 'Vadha'. Even the innocent flees having taken fright from this spraying one. This *Parjanya* thundering alonglight dates the miscreants.

But a minute observation pertaining to the critical examination of the Rg-Vedic, Yajurvedic and Atharva-Vedic *Sūktas* can afford an inlinking into the symbolic factor that can be construed by an interpretative study of the cultural background in which the expression has been employed in references of Vedic as well as Classical literature. According to A. A. Macdonell,

Parjanya invoked in full in three hymns is only mentioned some thirty times in the *R̥gveda*. The name in several passages still means simply 'Rain Cloud'. The personification is, therefore, always closely connected with the phenomenon of the rain storm in which the rain cloud itself becomes as udder, a pail, or a water skin often linked to a bull; *Parjanya* is characteristically a shedder of rain.³²

Dr. Kṛṣṇa Kumāra³³ construes '*Parjanya*' to mean - a cloud that showers rain. Taking '*janya*' as a technical word component he says - 'one that replenishes from all sides the sensate and the insensate objects that take birth in the Universe. While showering forth waters accompanied by lightnings or electric powers; Roaring in the spirit of a lion mounted on a chariot full of waters it promenades about in the sky. It has been called huge water vat called *ḍṛti*'.

"Kanikradad vṛsobhaḥ jiradāanuḥ reto dadhātyogadhīsu garbham³⁴

bellowing the bull of quickening gifts places. Seed in the palants as a germ.

"Vṛ-krān Vihantyuta hanti rakṣaso viśvam vibhāya bhuvanam Mahāvadhāt.

Utānāgā sate vṛṣṇyāvato yat parjanyaḥ stanayan hanti duṣkṛtaḥ³⁵
Divo no vṛṣṭim maruto rari-dhvam prapinnvata vṛṇo aśvasya dhārāḥ.

Arvāto etena stanayitnumehi apo niś-in-cannurah pitānaḥ³⁶

Abhi kranda stanaya garbhamādhā.

Udanvatā pari dīyā rathena.

Ḍṛtim sukarṣa viṣitam nyañcam

Samāḥ bhavantudvato nipādāḥ.³⁷

Mahāntam Kósumdacā niśiñca syandantām kulyāḥ viṣitāḥ Purastāt.

Ghṛtena dyāvā pṛthivī vyundhi suprapāṇam bhavat-vaghnīyā bhyaḥ³⁸

yat perjanya Kanikradat stanayan haṁsi duṣkṛtataḥ.

Pratīdam Viśvām modata Yat Kinīca Pṛthivyamadhī³⁹

avarṣirvarṣamudu ṣu gr̥bhāya akar dhanvanyatyetaḥ ū.

Ajījana oṣadhīrbhejanāya Kamuta Parjābhyi vido Manīṣām.⁴⁰

are the most important verses in the *Rgveda* V. 83 worthy of consideration from the point of view of the topic under consideration.

In these *mantras* words such as “*drte*”

“*Mahāntam kośam*” “*syandantām kulyah*” “*ghṛtena dyāvāpṛthivī vyundhi*” *Suprapāṇam bhavatvagnh.*

Yābhyah - are technical, *Kośa* in RV. I.11.2.11⁴¹.

Yābhiḥ sudānū auśijāya vaṇije dīrghaś- ravase madhu kośo akṣaraṭ; meaning the store of honey or a vat full of honey.” etc. *Somāḥ ati-vārānyavyā, divyāḥ na kosāso abhravarsāḥ, vṛthā samudraṃ sindhavo na nīcīḥ, Sutāso abhi kalasān - aṣṛgran*⁴².

Meaning:

“These Soma juices pass through the woden fleece like the rains of heaven showered by the clouds; the effused juices flow promptly to the pitchers as rivers running downwards How into the ocean.”⁴³

“*daśāśvān daśa kośān daśa vastrādhibhojanāḥ; daśo hiranya piṇḍān divodāsādasā-ṇiṣam*”⁴⁴

Meaning chest, trunk⁴⁵, along with “*Gobhīrvāṇo aiyate sobhariṇām rathe kośe hiranyaye.*

Gobhandhavah sujātā-saḥ iṣe bhujē, mahānto naḥ sparase nu”⁴⁶

“The voice of the (*Maruts*) blends with the songs of the *saubharis* in the receptacle of their golden chariot. May the mighty well born *Maruts*, the offspring of the (bridled) cow be gracious to us in regard of food, enjoyment and kindness.”⁴⁷

and “*Dr̥ti*” in RV IV 45.1

“*eṣa sya bhānurudiyarti yujyate;*
rathaḥ parjāṃ divo asya sānavi;
Pr̥kṣāso asmin mithuna adhi tryao
dr̥ti sturiyo madhuno vi rap̥sate”⁴⁸

“*dr̥t̥sturiyo*” here is significant of “a bucketful or a leather bag or a leather water machine for the inward and upward movement of water (*madhuno*) etc.- amply illustrates the point that in *Rgveda* V.83 7,8; *dr̥ti*” and ‘*kośa*’ have been associated with *Parjanya*. “*Dr̥tim su Karṣa viṣitam nyañcam*” is translated

by A. A. Macdonell- as "Draw well the water skin unfastened downward".

"*dṛtīm*" the rain cloud here is compared to a water skin doubtless like the leather bag made of a goat skin still used in India by water carriers"⁵⁰. Actuy it should mean

"Pull downwarde the well kint water machine" Provided with a water skin as in a "Çaṭasa" (a mechanical Pully system well) for the over flow of waters. Like R̥gveda V 83.8; VII 101.4;

*"Yasmin viśvāni bhuvanāni tasthuh
tisro dyādsstredhā sasrurāpaḥ,
trayaḥ kośāsaḥ Upasecanāḥ
Madhva cotantyaḥ hito virapśam"*⁵¹

Having '*trayaḥ kośāsaḥ ypasecanāsaḥ* is quite significant in so far as the sense of three *kośas* (water buckets or leather bags (*kośa* being a synonym of *dṛti*) provided on to a water pulley moving up and down in order to fill up water from a well or a reservoir and to bring it up and then to send it down.

"*Madhvaḥ*" occurring in IV, 45.3⁵²; X.73.9⁵³ has been invariably meant sweet juice or sweet water symbolically in the form of honey, mead etc., as in "*Āprīsūktā*" (RV I.142 1-13⁵⁴) (*samidho' agnā-vaha devān adya yatasruce*)⁵⁵;

*ghṛtavantamupamāsi modhumantam tanūnapāt.*⁵⁶
*Suciḥ pāvako adbhuto madhvā yajḥam mimikṣati*⁵⁷

Dr. Deo Prakash Pātañjala Śāstri has construed '*madhu mañtam*' as having water and '*ghṛta vartam*' as having heat and light⁵⁸. VII.102.2.1⁵⁹ also contains the word '*Madhumattamaṃ*' as an epithet of *parjanya*.

*"Parjanyaḥ pragāyata; divespṛtāya mīḥuṣe;
Sa no yavasamicchatu. yo garbhamaṣadhīnām
Gavāṃ kṛṇoty arvatām. parjanyaḥ puruṣiṇāmY.
Tasmā idāsyē havirjuhotā madhumattamaṃ glāṃ
naḥ saṃyotam Karat"*.

In RV. IX. 113.3⁶⁰

"*Parjanya vṛddham mahiṣam taṃ sūryasya duhitābharat.*" is also symbolic of the point that a buffalo swollen by *parjanya* may mean that leather bags of a 'Caṭasa Well' swollen by water while coming down and going upwards. *Sūryasya duhitā*" may be Uṣa the daybreak when wells play admirably.

In classical literature Kālidāsa in Raghvaṃśa XVII.15⁶¹ "*Stūyamānaḥ kṣaṇotosminnalakyata saḥ vandibhiḥ. Prayrdha iva parjanyaḥ sārāṅgair abhinanditaḥ.*" and Samarāṅgaṇasūtrdhāra of Bhoja-XXXVI.5⁶² "*Ājyena payasā dadhña pūjayacchi khinaṃ punaḥ. Śāligodhūma mṛdvādyai rdhānyaih parjanyamarcayet.*" Can also be construed symbolically to mean the same apparently cloud but symbolically a water machine.

Dhanapāla in his *Tilakamañjarī* has referred to the term 'Caṭasodaka' construed by the commentator as 'Carmapuṭajalam' in the following prose compound. "*Āgantuka pipāsā prati kriyodyukta bhukta parijana Punaruktopapādita recyamāna caṭasodakeṣu*"⁶³ caṭasa has been construed as a synonym of 'carmapūṭa' by Medinīkara.⁶⁴

In *Amarakośa* 'dr̥ti' also means a bellows-" *dr̥ti-sīmanta harite romanthodgītha budbudāḥ*"⁶⁵. Hemacandra in *Abhidhānacintāmaṇi* has it as "*dr̥tiḥ khallaś Crma mayī valuḥ karakapātrikā*"⁶⁶ *Sir Monier Williams takes it as a skin or leather, a leather bag for holding water and other fluids (figuratively a cloud) a pair of bellows.⁶⁷ or bloated skin.

Parjanya vṛddham mahiṣam-has been translated (RV IX.113.3) along with *Sūryasya duhitābharat.* as "The daughter of Sūrya brought the vast soma large as a rain cloud"⁶⁸ On *Rgveda* V.83.8 A. A. Macdonell's remarks:

"The process of shedding rain here is compared with the drawing up of a pail from a well and pouring out the contents" in illustration of-

"Mahāntaṃ kośamudacā niṣṭca.
Syandantāṃ kulyā viṣitā purastāt.
Ghṛtena dyāvāpṛthivī vyundhi.
Suprapāṇaṃ bhavatvaghnyābhyāḥ.

i. e. Draw up the great bucket pour it down: Let the streams released flow forward: drench heaven and earth with ghee

(or water) or grease; let there be a good drinkins place for the cows”.

-amply corroborate the view expressed by me above that, 'Parjanya' the god invoked by the Seers in RV V. 83, VII 101, 102, 103 refers to a Vedic contrivance of a mechanical water machine having buckets in a circle or a row moving up and going down made of leather and supplying water for irrigation purposes.

“Rgveda IX.96.6” *Mahiṣo mṛgānām* has ‘*Mahiṣa*’ to mean a ‘Buffalo’ In RV IX.113.3 also we can equally construe- “*Parjanya vṛddham mahiṣam*” as a buffalo grown up along with the water machine whom the daughter of Sūrya i.e. Morning twilight brought up symbolically. A buffalo is dark. The bellows is equally dark or it is normally made out of buffalo’s hide.

The allusion of Kālidāsa. “*Pravṛddha iva Parjanyaḥ Sāraṅgarnabhinanditaḥ*”⁷² can also mean: “Water machine of huge norm welcomed by the peacocks, Elephants or spotted antelopes or by thrush birds (Cātaka) teh variety of senses taken by Sir Monier Williams.”⁷¹

Hence etymologically viewed and construed by a comparative study of the Rgvedic hymns. *Parjanya* to me is a symbolic term for ‘Mechanical water machine’ having ‘*dṛtis*’ forming its components employed for the transference of water in a streaming flow for purposes of irrigation (a *bhrāntimadvāriyantra*) of *Mālavikāgnimitram* of Kālidāsa Act II.12.

“*Bindūtksepānpipāsuh paribhramati*
Sikhī bhrāntimadvāriyantram”⁷³

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10. *Ibid* p.391. ālāktā yā Ruruśīrṣnyatho yasyā ayo mukham̐; idam̐ parjanya retasa iṣvaṭ devyai bṛhannamaḥ.
11. *Ibid*. p. 625 parjanya vṛddham̐ mahiṣam̐ tam sūryasya Duhitābharat. tam gandharvāḥ pratyagr̥bhanan, tam some rasumādadhurindrāyendo parisrava.
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15. Viśvaśvarānanda Viśva Bandhu Institute of Sanskrit and Indological studies, Panjab University, Hoshiarpur, edited by K. V. Sarma; M. Mishra University of Delhi, Delhi.
16. *Purā yat sūrastamaso apītestamadrivaḥ phaligaṃ hetimasya. Śuṣṇasya cit parihitam̐ yadojo divaspari sugrathitam̐ tadā R̥gveda* I 121.10 p. 92 opcit. Cf 8 above.
i.e., when the sun (had emerged) from the struggle with darkness, then didst break the wonder of the thunderbolt, the colud that had been his annoyance and didst Sunder the well fastened covering in which Shushna had enveloped him. H. H. Wilson on *R̥gveda* Vol I. p. 201. Bangalore, 1946. also *R̥gveda* I.62.4.

“Sa Suṣṭubhā sa-stubhā saptaviprath,
Svareṇādriṃ Svaryo navag-vaiḥ.
Saraṇyuhīḥ phaligamindra śakra

Valaṃ raveṇa darayo daśag vaa” *ibid.* p. 43.

Powerful Indra, who art to be guarded with a laudatory and well accented hymn by the seven priests whether engage for nine months or ten, and desirous of (safe) protection than hast terrified by thy voice the cloud.

H. H. Wilson Vol I *op. cit* p. 96; *R̥gveda* VIII 32.25 p. 499.

Ya udgaḥ phaligaṃ bhinannyak sindhūnavāsṛjat. *Yogoṣu pakvaṃ dhārayat.*

i.e. who drove the cloud for (the issue of the rain, who sent down the waters: who placed the matter mature (milk) in the cattle. H. H. Wilson *R̥gveda* Vol V 89, Poona, 1928

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45. Dr. Suūrya Kānta *Op. cit* p. 259.

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 'The glowing sun is rising. The chariot of Aśvini Kumaras' is advancing towards all. Sun is endowed with a brilliant chariot. This chariot has over it triplefold felly and a vat full of juice is adorning it as a fourth constituent.'
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52. *Madhvaḥ prabataṃ madhupebhirāsabhiḥ,
 Uta priyam madhune yañjāthāṃ rathaṃ.* Ibid p. 269.
53. *Cakraṃ yadasyapsvā-nūpattam;
 Uto tadasmai madhviccachadyāt;
 Pṛthivyāmartiṣitam yadūdhaḥ payo goṣvadadhā oṣadhīṣu*
 Ibid p. 689.
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- Thou measurest out to (the sacrificer possessed of ghr̥ta (heat) and madhu (water) O Jānūnapāt, The sacrifice belongs to the wise and zealous giver like me and 'Bright purifying wonderful (Agni)
 Wants to sacrifice with water, etc.'
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Water Exploration In Ancient India

G. V. TAGARE

Water is essential for agriculture whether ancient or modern. Agriculture in India depended mainly on rainfall since ancient times. People knew that much of the rain-water percolates through the soil and flows underground through "veins" as blood does in our body. By observation of trees, soil and such other external indications and by actual digging of wells, people arrived at certain broad conclusions though they did not have remote sensory apparatus, air-craft for conducting aerial surveys or any LANDSAT satellite to supply detailed photographs of the land surveyed. They recorded their findings in short compendiums which later developed into schools or traditions

Today I propose to state briefly what Varāhamihira, the great astronomer of the 6th century A. D. recorded about water exploration of his times. Varāhamihira (VM) was an astronomer of international outlook. He based his work on astronomy the *Bṛhajjātaka* on the *siddhāntas* of Pitāmaha, Romaka, Pauliśa, Vasiṣṭha and Sūrya. Out of these, Romaka indicates some Roman work, Pauliśa is of Paulus Alexandrimus, and the so-called *Sūrya Siddhānta* was imparted by the Sungod

to Asura Maya at Romaka. VM expresses his appreciation of the works of western astronomers by calling them adorable like *Rsis* in his *Brhatsamhita* (BS) 2.15 as follows:

म्लेच्छा हि यवनास्तेषु सम्यक् शास्त्रमिदं (astronomy) स्थितम्।
ऋषिवत् तेऽपि पूज्यन्ते।

The BS on which I have based this paper is an encyclopaedia of the India of the 5th-6th cent. A.D. It deals with different branches of knowledge such as astronomy-cum-astrology, geography, architecture, civil engineering, water-exploration, iconography, prognostic characteristics of women and animals, jewellery, prosody (both Sanskrit and Prakrit) etc.

The present paper is based on the 54th Chapter of the BS. Its title is DAGĀRGALAM. (दगार्गलम्) a compound of Prakrit and Sanskrit word: Daga (दग) - Sanskrit *udaka* (उदक) 'water', and *argala* "An impediment". Such Prakrit-Sanskrit or Sanskrit-Prakrit compounds were current in the speech of common people as can be seen from the conversation of *Pāthaśālā* boys in another contemporary work, the *Kuvalayamālā* (vide G. V. Tagare- *History of Prakrit Literature*, pp. 320-322). The significance of the chapter is that it deals with "under-ground water". This chapter consists of 125 verses. The first part of the Chapter—verses (*Āryās*) 1-99 are based on Sārasvata Muni's work and the rest (VV.100-125) on that of Mānava Muni. From the observations, divinations etc., about underground water by Sārasvata Muni, it appears that he was an expert in botany and zoology with some knowledge of geology also. Muni Mānava was a geologist with subsidiary knowledge of botany and zoology.

Before I record the summary of some of the findings of those ancient scholars, I should plainly state the limitations of their theories, if they are to be verified today:

1. The author, Varāhamihira belonged to Ujjain. As such, his observations are limited to the Indo-Gangetic plain in general and Malwa in particular.
2. The work was written in the 6th Century A. D., and during the last 1500 years there have been climatic changes.

3. Much more important than these is the very favourable man-land-forest ratio of that period. In 1947, 33 per cent of land was covered with forests in India. Today they say that it is about 11 per cent. If this progressive deforestation continues, God forbid, but, I am afraid, we shall be contributing a great desert of India' to the world-map, as underground water depends on the rainfall. Hence, I doubt how far the old conditions are verifiable.

In the Introduction to the BS. VM. tells that though the rain-water as it falls from the sky may have the same taste and colour, it varies in taste and colour due to its contact with the earth (soil) of different types. It should be tested with reference to its surroundings. This needs be taken into account when we live in jungles of concrete surrounded by vast slum-areas. There are some commonsense observations such as: The water-table (of the ground water) varies according to the rain-fall; water in a well or a tank is rain-water percolating through different types of soil; underground water flows through the "veins" of the earth.

The Sārasvata School

The observations are given in the following way:

- 1) If in an arid land, there is an Indian fig tree (*udumbara*) three cubits to its west, at a depth of $2\frac{1}{2}$ *puruṣa* (the height or measure of a man) plenty of water will be found. (11)
- 2) If to the east of a *jambū* tree, there is an ant-hill, water will be found below two *puruṣas*. (9)

In this way Sārasvata goes on predicting water

- 3) If an ant-hill is near the trees called *arjuna*, *nigadi*, *badari* etc. (12-16)
- 4) If in arid area, *kampilla* tree (Marathi *Rui Māndāra*, (*Rottleria Tinctoria* ?) is found there is water at a distance of three anlits to the east (21)

In brief, it may be stated that the presence of an anthill or that of a serpent den is regarded as an indication of the underground water. A number of trees like the banyan. *sāmī*,

udumbara, palās, bilva and many other trees are listed as having water at a particular depth at its particular direction (The list is too long to be given in a short paper like this)

An illiterate water-diviner told me that when he kicks the ground he feels the resonance of water underneath. I did not believe in it. But I find the same test given in v. 64 of the *BS. Sārasvata* gives one general caution. The depth at which water can be found depends on the nature of the soil e.g., arid etc.

एतद् अनूपे वाच्यं जांगलभूमौ तु पञ्चभिः पुरुषैः ।

एतैरेव निमित्तैर्मरुदेशे सप्तभिः कथयेत् ॥८९

“The above mentioned indications are applicable to a watery country (*anūpe = bahūdake*). In semi-arid land, water should be predicted as being under five *puruṣas* and in arid land (*Marudes'e*) as under 7 *puruṣas*.”

In v.99 VM. tells that this section was based on the *Dagārgala* in of *Sārasvata* and the remaining chapter is based on *manava Munis* work :

Maṇava Muni's *Dagārgala*

Mānava Muni seems to be a geologist. He surmises the presence of water by the colour of the soil or of the rocks and stones. He says: If the soil is of the colour of the sun, fire, ashes, camel or donkey, there is no water underneath. Where the earth is red, bamboo-sprouts are red and milky, there is water. A stone or rock like beryl in colour or like green gram, or dark like a cloud, ripe fig, bee, collyrium or is brown, water is in plenty below. A rock like a pigeon, honey, ghee, silken cloth in colour, indicates inexhaustible supply of water. There is no water under a rock full of red or variegated spots, is pale white or ash-like in colour or like a camel or a donkey or an *anguṣṭika* flower-like in colour but if the rock is like the moon light, gold, sapphire or pearl like in colour, they contain water underneath (VV.106-110).

In vv. 111-117 methods of breaking a rock or a slab of stone are given. *Mānava Muni* has given a list of the plants or trees which indicate presence of water, in what particular direction of the tree and at what depth.

Reading both the sections one finds that the old water diviners had considerable knowledge of botany, geology and zoology current in pre-sixth century A.D.

Varāhmihira concludes: "on the authority of Baladeva, I explained rainshowers that fall after the full moon day of *jyeṣṭha*. This second method of water exploration under the earth is properly explained by me - Varāhamihira.

Varāhamihira was a great scientist of his age. His findings should be verified in the area to which he belonged, i.e., M. P. and not in the Deccan trap of our area. i.e., Maharashtra.

Some Specimens (Excerpts) Of The Text.

1. If in arid (waterless place one finds a *vetasa* plant (*Calamus Rotang*) and if the ground at a distance of three cubits to the west of that plant is dug, for half a *puruṣa* there is certainly water.
2. In the case of an *udumbara* tree, if you dig two *pruṣas* deep to three cubits to the west of that tree, you will find a vein i.e., current of sweet water.
3. When a *bilva* and an *udumbara* tree are found growing together you will find water $3\frac{1}{2}$ *puruṣas* deep if dug at a distance of 3 cubits.
4. If there is an anthill to the north of an *arjuna* tree and if you dig three cubits to the west of that tree, water will be found at a depth of $3\frac{1}{2}$ *puruṣas*.
5. If there is a cocount tree with anthills, there is a vein of good water flowing at a distance of 6 cubits to the west, at a depth of four *pruṣas*.
6. If a *nirgundi* tree is found with an anthill, you will get sweet water at a depth of 2 *puruṣas* to the south of the tree at a distance of 3 cubits from the tree.
7. If an anthill is inhabited by a serpent and is near to the north of *madhuka* tree, if you dig at a distance of 5 cubits from the tree there is water under $7\frac{1}{2}$ *puruṣas*.
8. Water is found near "Milky" trees, having long branches or very short in height; but there is no water if the trees are sickly.

9. The spot where trees, shrubs and creepers are fresh and fine and the leaves are entire (untorn), there is ample water under three *puruṣas*
10. Where there is grass of the type of *gokshura*, *kuśa*, *nalika* trees and shrubs with milky juice, and trees like *vibhītaka*, *Nāga keśara*, *padma*, *nīpa*, water will be found at a depth of 3 *puruṣas* even if these are found on an elevated or higher ground.

The above is a random selection of verses. Hence the verse numbers are not given. These are from the 54th chapter of the *Bṛhatsamhitā*.

It is noteworthy that this chapter is given after the chapter dealing with construction of houses. It is followed by a chapter on horticulture.

Fertilizers In Ancient India

R. P. DWIVEDI

It is well known that the increase in population of independent India has assumed alarming proportions thereby rendering the problem of feeding the growing population almost unsolvable. Not one of the knowers of science and technology are thinking of finding new ways and means for increasing the produce from agriculture. They are mainly interested in reducing the wastage by eradicating the plant pests and diseases as well as by devising proper storage methods. In this context, it becomes significant to think of the efforts made in fertilizing trees as well as plants in ancient India.

It must be said to the credit of the thinkers in the Vedic age

घृतेन सीता मधुना समक्ता विश्वेदेवैश्नुमता मरुद्भिः।

सा. नः सीते पयसाभ्याववृत्स्वोर्जस्वती घृतवत् पिन्वमाना ॥¹

Indian's most important contribution to the world of agriculture is rice (*Oryza Sativa*), the staple food and crop of most of the south, south-east and east Asia; sugarcane varieties of legumes and tropical fruit like the mango also are native to the subcontinent. Archaeological records of this region's prehistory are still incomplete and uneven and evidence of how the transition from pastoralism to crop forming took

place and is taking. Nothing is known, however, about the farm communities that must have produced a surplus of agricultural products sufficient to sustain the population and fill the granaries of the metropolitan centres.

Of course, but it is not clear at what particular time agricultural production took place and by whom specially in India. Nevertheless from the Vedic age some kind of manure or fertilizers were used to make fertile the land for good production. In the III *Kaṇḍa* of *Atharvaveda* the word “करीषिणीः” used for the earth is indicative of the fact that Indian agriculturists were familiar with manures and fertilizers.

संजग्माना अबिभ्युषीरस्मिन् गोष्ठं करीषिणीः ।

विभ्रज्जी सोम्यं मध्वनमीवा उपेतन ॥

— अथर्व. ॥ ३।१।४३ ॥²

It is known that in the post— Vedic age viz, *Brāhmaṇa*, *Aranyaka* and *Upaniṣadic* age, agricultural practices developed and they followed rotation method to increase the soil fertility. *Agnipurāṇa* in chp. 282 on *Ṛksāyūrveda* has laid down rules about the trees to be planted in gardens, grafting and transplantation of trees as well as diseases of trees and their treatments to fight them. *Anupaja* trees are mentioned in connection with transplantation and grafting. Our ancients have also given a diagnosis of diseases of trees and their treatments to overcome the diseases.

विडङ्घृतपङ्काकान्सचयेच्छीतवारिणा

फलनाशे कुलत्थैश्च भाषैर्मुद्गैर्वैस्तिलैः ॥

घृतशीतपयः सेकः फलपुष्पाय सर्वदा

अविकाञ्चशकृच्चूर्णं यवचूर्णं तिलानि च ॥

गोमांसमुदकं चैव सप्तरात्रं निघापयेत्

उत्सेकः सर्ववृक्षाणां फलपुष्पादि वृद्धिदः ॥

मत्स्याम्भसा तु सेकेन वृद्धिर्भवति शाखिनः

विडङ्घ तण्डुलोपेतं मात्स्यं मांसं हि दोहदम्

सर्वेषामविशेषेण वृक्षाणां रोगमर्दनम् ॥³

On the same topic, Varahamihira also discusses in his eminent work *Br̥hatsaṁhitā* in chp. LV dealing with gardening and agriculture. He speaks about the sesamum treatment for the

soil to prepare for gardening and agriculture.

मृद्धी भूः सर्ववृक्षाणां हिता तस्या तिलान् वपेत्।
पुष्पितास्तांश्च मृदनीयात्कर्मैतत्प्रथमं भुवः॥⁴

On the subject of distance between two trees in a garden Varahamihira says that trees should be planted 20 cubits apart. He also discusses the diagnosing of the diseases of trees and their treatment. In this connection he speaks that trees get diseases from cold weather, strong winds and hot sun. Cosequently, their leaves become palewhite, sprouts scanty and sickly, branches dry, and their milk oozes out.

शीतवातातपैरोगो जायते पाण्डुपत्रता
अवृद्धिश्च प्रवालानां शाखाशोषो रसमृतिः॥
चिकित्सितमथैतेषा शस्त्रेणादौ विशोधनम्
विडङ्घृतपडकाक्तान् सेचयेत् क्षीरवारिणा॥⁵

Kautilya also deals with this problem in his *Arthasāstra* XL *Prakarana*, chp. 24 सीताध्यक्षः. He expects the superintendent under of this department to be in the know of not only the science of farming but also of *vṛkṣa jñāna*. In fact, he wanted this officer to be in touch with different methods of tilling the land and making use of the rainwater in enhancing the fertility of the soil

सीताध्यक्षः कृषितंत्रशुल्बवृक्षायुर्वेदज्ञस्तज्ज्ञसखो वा सर्वधान्य
पुष्पफलशाककन्दमूलवाल्ग्लिक्यक्षौमकार्पास बीजानि यथाकालं गृहणीयात्।
तुषारपायनमुष्ण शोषणं चासत्परात्रादिति धान्यबीजानां त्रिरात्रं पञ्चरात्रं वा
कोशी धान्यानां मधुधृत सूकरवसाभिःशशकृद्युक्ताभिः काण्डबीजानां छेदलेपो
मधुधृतेन कन्दानाम् आस्थिबीजानां शकृदालेपः। शाखिनां गर्तदाहो
गोस्थिशकृद्भिः काले दौहदं च। प्ररुढांश्चाशुष्ककटुमत्स्यांश्च स्नुहिक्षीरण
पाययेत्। कार्पाससारं निर्मोकं सर्वस्य च समाहरेत्॥⁶..... न सर्पास्त्रत्र तिष्ठन्ति
धूमो चत्रैष तिष्ठति॥⁷

The subject of 'dohada' of trees and plants often referred to by Sanskrit poets and dramatists really underlines the special treatment of manure or fertilizer; *dohada* which comes under *kavisamaya* i.e., poetic conventions cannot be summarily dismissed as flights of fancy only. The famous verse in *Ratnāvalī* (II.30) viz., *uddāmotkalikam* has spoken of the wonderful

appearance of abundant flowers on the favourite jasmine creeper of the king as a result of application of a fertilizer supplied by a hermit.

From a study of the great works of Sir John Lubback, Mr. Tylor, Mr Fergusson and Mr. Monier Williams and other savants in the field, it is learnt that man first worshipped trees as gods themselves. He believed that the tree had a soul of its own. Later on, as time advanced, the idea dawned on him that trees might become the receptacle of the spirits of gods and that they were peculiarly liable to be occupied by ghosts and goblins.

M. G. Subramayam Pillai in his work "*Tree Worship and Ophialatry*" mentioned that if a coconut, mango or tamarind tree had failed to prove floriferous and fruitful, the barren tree is beaten with a pestle on a day of eclipse and this method is believed to cure the tree of its barrenness.⁷

The jingling anklet worn by a beautiful maiden helping the aśoka tree to blossom, if analysed may lead to some principle of sound and music therapy giving rise to physical vibrations in plants. Scientists to-day have already come to the conclusion that music comes to the help of life and growth of the plants and contributes to their growth and yields. Dr. T. C. N. Singh, a retired professor of Botany, Annamalai University, has come to the conclusion that the sound of 'Vinā' produces better results in plants than that of a violin. Experiments have been conducted in the U.S.A., Canada, and the U.S.S.R. and it has been established that musical therapy considerably helps the plants to give better yields.⁸

Not only in ancient times but even now-a-days I found in the North India the agriculturists applying fish, blood etc., as a manure to better the yield.

Mention of some fertilizers in *Abhilāṣītārthacintamaṇi* viz., scratching the tree with thorns and fumigating them with cow's ghee, water and fat of parrots and rats, as well as fumigation of trees by burning turmeric, white mustard etc., clearly indicate that the topic of fertilization had received sufficient attention. A mention has been made in some Sanskrit works on

vrkṣāyurveda that creepers besmeared with honey produce red flowers. Recipes for making fruit remain ever-green are also found. It is interesting to note that cross-breeding of plants was also practised by the ancients. A mention has been made that the plantain trunk if watered with the flesh and serum of a boar and decoction of *añkolā* bears a pomegranate.

The treatment of this subject in *Abhilāṣitārthacintamaṇi* speaks of a give and take between specialists of the so-called north and south as genius need not be cabined and confined to a particular clan or a race. This is just in keeping with the rational approach of thinkers in ancient India, who were never opposed to observation and experiment, although they believed in *dharma* to be the focal point and the guiding star.

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Fertilizers In Ancient India

RAMA BAI

Ancient Indian seers had established that plants were also living beings with the difference that their consciousness—*samjñā* was internal or dormant (*Manu* I.49). They have feelings of both pain and pleasure. Just as preventive and curative medicines and tonics are prescribed for human beings, for the plants also are prescribed medicines and tonics. In ancient works on *Śilpaśāstra* (architecture) (*Śilpaśāstra* of Viśvakarman LXVII.3; LXVIII 8-10; LXX.7.8) Kauṭilya's *Arthaśāstra*, Jolly's edn. 11.20. p.70 and Varāhamihira's *Bṛhatsamhitā*, we come across sections dealing with trees or *vṛkṣāyurveda* in connection with agriculture, gardening and town-planning. In the *Atharvaveda* too (I.2.6, III.6.4) there are prayers for the sweet and juicy fruits of trees and creepers. Many ancient sages like Kaśyapa, Gārgya and Parāśara and mediaeval scholars like Cakrapāṇimiśra, Somapāla and King Somadeva III of the Chalukyan dynasty have written on this subject. Fertilizers and manures play a very important role in agriculture. When the soil loses its fertility proper manuring has to be done in order to get good and abundant yield. We find that our ancients had paid much attention to this aspect of agriculture.

Varāhamihira in his *Bṛhatsamhitā* in the LV *adhyāya* deals with the treatment of trees, elaborately. According to him,

sesamum should be sown and when in bloom should be crushed¹. This is the first step in preparing the soil. This corresponds to modern green manure. Another manure² described by Varāhamihira is the watering of the trees and creepers by milk—boiled and cooled and mixed with horsegram, blackgram, greengram, sesamum and barley. This mixture should be applied to the trees and creepers when the flowers or fruits of which are destroyed suddenly (V. 16). Again he mentions a third type of fertilizer³. i.e., trees, creepers and bushes should be sprinkled daily with a mixture of two *ādhakas* i.e., 128 *palas* with the powder of the dung of goats and sheep, one *ādhaka* of sesamum, 16 *palas* of wheat particles one *tula* (100 *palas*) of beef and one *droṇa* (256 *palas*) of water, kept for seven days.

If seeds are to be sown or young trees to be planted, which would produce good results, the soil should be manured in the following manner. First a pit should be dug and it should be filled with plenty of bones and cowdung or any other dung and the same should be burnt. Then the ashes have to be removed and the pit has to be filled up with a layer of sand at the bottom and over it a layer of the flesh and serum of goats with water should be made. If seeds are sown in such pits the seeds will produce very good trees.

The soil of the pit of a tree struck with lightning may be brought and put into the pits of the park trees with a view to avoid the trouble of snowfall.

Cooked white rice mixed with curds and rock-salt is also thrown into the pits with a view to attract hail-storm.

विद्युदाहतवृक्षस्य भूतिमादाय सर्वतः ।
 रक्षार्थं विकिरेदेषां तथा न हिमबाधनम् ।
 सितशालयोदनं दध्ना सैन्धवेन युतं बने ।
 क्षेपणीयं च परितो गराणां वृष्टिवारणम् ॥

Sārngadharapaddhati—*Upavanavinoda* Bombay
 Skt. Series XXXVII pp. 309-340.

Abhilāṣitārthacin̄tāmaṇi describes that perfuming the trees with the smoke caused by burning *niśa* (turmeric *kunkuma*), *viḍaṅga*

(*erycibe paniculata*), *Siddhartha* (white mustard), the flowers of Arjuná plant, mixed with fish and the flesh of *rohita* (a kind of deer) is not only conducive to the abundance of flowers and fruits but destructive of all worms and insects and also of diseases.

The perfume caused by the burning of *Vidanga*, *Hingu* (asafoetida, *siñdhūra* (red lead or *Grislea Tomentosa*), *marica* (pepper), *vaca* (a kind of aromatic root), *bhallataka* (*Seme carpus Anacardium*), and buffalo-horn mixed in equal quantities will destroy all kinds of insects and worms.

Perfume caused by the burning of fish, clarified butter, white mustard and plantain leaves will be conducive to the abundance of fruits.

Trees watered with the fat of *kīra* (parrot) and *kuranga* (a kind of deer) will produce abundance of fruits in all the seasons.

Milky trees watered with milk mixed with *viḍaṅga*, honey and clarified butter and perfumed with the smoke caused by the burning of *nata* (*Tabernacmontana*) and *kuṣṭha* (*Costus speciosus*) will always produce fruits.

Creeping plants (?) watered with the decoction of *kuṣṭha* (*Alangium Hexapetalum*) mixed with the milk and fat of cows and *agara* (*Agallochum*) will always bear fruits.

Pomegranates manured with the grease and flesh of a deer, elephant, cat, *kroḍha* (wild bear) and *chapa* will bear abundant sweet fruits.

Oranges manured with any flesh (*palala*) mixed with cow's milk and jaggery will bear plenty of fruits.

Mango trees watered with the decoction of *ankola* (*Alangium Hexapetalum*) mixed with honey and the fat of a wild boar will always bear fruits. The *Upavanavinoda* gives a different manuring for this. Like this we find many fertilisers for different trees and plants in *Abhilāṣitārthaciñtāmañi*, also

कुरङ्गकिटि सारंङ्ग शृगालाश्वादिमेदआ, कथितेन सदुष्येन

पञ्चपल्लववारिणा । कृतसेको भवेदाशु सहकारेऽतिसौरभः ॥

— *Upavanarinoda*

For example:

- 1) Honey, clarified butter, jaggery and milk mixed together makes a good manure for *kapittha* - cf: *Upavanavinoda*

सर्पिर्गुडक्षीरमधूपचारं दत्त्वा निषिक्तौ च कपित्थविल्वौ ।

पीयूषकल्पान्यतिमांसलानि फलान्यनस्थीनि सदा दधाते ॥

- 2) Powder of *japa* (China rose), *tila*, and equal quantity of honey and clarified butter - for *Āmalaka*.
- 3) The paste made of *vidaṅga*, *māṣa*, *madhuka* (Liquorice root), *surabhi* and *jāti* mixed with *madirā* (liquor) and salt for coconut tree.
- 4) The paste made of the powder of an ivory piece and elephant's tooth thrown at the root of the plantain tree, even in a mixy soil, and when covered with fresh soil, will bear fruits as big and long as an elephant's trunk.
- 5) The mixture of oil-cake, liquor and fish is a good fertilizer for *bijapūra* tree - cf. *Upavanavinoda*

अजैडकासूकरविड्विडङ्गकिण्वोपचरिण च बीजपूरः

भूयोऽश्वमूत्राविलवारिसिक्तः फलानि यत्ते सुबहूनि शशवत् ॥

Similarly we have good manures for tamarind tree, aśoka, tilaka tree, syāma creeper, mallika, japa, karṇikāra etc.

Plants producing flowers having no smell will bear fragrant flowers when they are manured with the soil taken from the pits of plants bearing fragrant flowers and are watered with the water mixed with the powder of *gāndhapatra* (sandal tree leaves), *musta* (*Cyperus rotundus*) *tagara* (*Tabernaemontana coronaria*) and *uśira* (*Andropogon Municaus*).

The *Viśvavallabha* of Cakrapānimisra also mentions such manures for trees and creepers. The *Vṛkṣāyurveda* of *Śrīpāla* as well as the *Upavanavinoda* mention a fertilizing solution called *kuṇapajal*. This solution is prepared thus - flesh, marrow of bones and flesh and fat of the deer, hogs, fish, sheep, goats and saṅgins as far as possible, should be mixed together and should be cooked in water. When it is sufficiently cooked, should be poured into a pot and milk should be added to

it. Then powdered oilcake of sesamum and honey should be added. Mix the same with soaked black-gram and ghee. Spread this mixture in a shallow vessel and pour hot water on it. When this is transferred to a pot, the latter should be sealed and buried for a fortnight in a room. The contents of the pot are now called *kuṇapajala* which becomes a tonic for the trees.

कुरङ्गकिटिमत्स्यानां मेषछागलखड्गिनाम् ।
 मांसं ग्राह्यं यथालाभं मेदोमज्जावसास्तथा ॥
 तान्सवनिकतः कृत्वा वह्नौ नीरेण पाचयेत् ।
 संपक्वं हि क्षिपेद्भाण्डे तत्र दुग्धं च क्षिपेत् ॥
 चूर्णाकृत्य खलिर्देया तिलानां माक्षिकं तथा ।
 स्वित्रांशच सरंसान्माषांस्तत्र दद्याद् द्यूतं तथा ॥
 उष्णं जलं क्षिपेत्तत्र मात्रा नास्तीह कस्यचित् ।
 पक्षैकं स्थापिते भाण्डे कोष्णस्थाने मनीषिणा ।
 कुणपस्तु भवेदेव तरूणां पुष्टिकारकः ॥

According to Surapāla's prescription *mārulunga* fruits would become as big as *kuṣmāṇḍas* if its creeper be watered with a solution of oil-cake, fish-meat, rat-flesh and liquor in water.

Bilva and wood-apple trees would bear sweet fruits if they be watered, before their flowering season, with a solution of honey, ghee, milk, jaggery and its sediment. (सर्पिर्गुडक्षीरमधूपचारं दत्त्वा निषिकतौ कपित्यबिल्वौ।)

The *Kautukacintāmaṇi* gives a prescription for making grapes sweet and to remove sourness of mangoes.

The *Agnipurāṇa* has a section dealing with *Vṛkṣāyurveda*.

Thus we see that our ancients possessed sufficient capacity and evinced enough enthusiasm for analytical thinking and scientific experimentation in agricultural activities and they gave much importance to green manure.

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२. फलनाशे कुलत्यैच माषैर्मुद्गैस्तिर्यैर्विः । शृतशीतपयःसेकः फलपुष्पसमृद्धये ॥
३. अविकाजशकृच्चूर्णास्याढकेद्वे तिलाढकम् । भक्तुप्रस्थो जलद्रोणो गोमांसतुलयासह ॥
 सप्तरात्रोषितैरैः सेकः कार्यो वनस्पतेः । वल्लीगुल्मफलानां च फलपुष्पाय सर्वदा ।

Women, Forests & Agriculture

S. D. BHATT

We are midst an ecological crisis because of man's so called conquest of Nature. Conquest? or meddling?! Chemical effluents, nuclear waste, pollutants and increasing Carbon-di-oxide in the atmosphere have culminated in the ecological disaster, because of the so-called-wiser homo sapiens. Ecology includes all species of life, but the supposed to be 'thinking species' has dug its own grave by its 'most' unthinking behaviour! But the ancient Indians were practical and considerate because they knew and understood the nature of *Nature, forests, agriculture* and the feminine principle. They were practitioners of the slogan "Forestry supports to Agriculture and animal Husbandry."

Our ancient Indians acted individually but thought globally and in relation to nature. Agriculture survived because forest, survived, forest, survived because they were an inseparable part of *nature*, both in principle and in practice. To them *Nature* symbolised the embodiment of the feminine principle *prakriti*. *Nature* was an expression of *śakti*, the feminine and the creative principle of the cosmos. To produce, provide, sustain and renew are the activities of *Nature/Forests* or *aranyāni*.

Forests have always been at the core of Indian civilization. They have been worshipped "*Aranyāni*", the Goddess of Forest, the primitive source of life and fertility. In folk and tribal cultures, trees and forests were worshipped as *Vana Devatas*. In Bengal, she was associated with *Sherora tree*, *Sal* and *Asvatha*, in Assam she was *Rupeshwari*, *Adi*, *Lalitā*, *Mother Earth* (*Devī Māhātmya*) '*Great Mother*' image as a symbol of sympathy and fertility has been worshipped, since pre-historic times under various names and various forms.

Prakṛti lies in stones, trees, pools, animals, fruits, rivers and mountains. Indians, especially women worshipped all these. *Tulsi* was sacred not only as a plant with curative properties but as *Bṛindāvan* the symbol of the Cosmos. In the daily worship women renewed the relationship of the home with the Cosmos and with the world process. Ontologically life in all forms arose from the feminine principle. Our ancients knew that the ecological ways of knowing *nature* were participatory. *Nature* herself was an experience and women were sylviculturists, agriculturists natural scientists and water resource managers.

Women produced and reproduced life not only biologically but also through their social role in providing sustenance. They did this by managing the cycles in forestry and agriculture.

They transferred fertility of the forests to the fields and to animals. They also transferred animal dung/waste as fertilizers for crops and crops to animals as fodder. The Indian villages even today have pits for the waste in their backyards. Women worked with the forests to bring water to their fields and families.

This partnership between women and *Nature* ensured sustenance. They, therefore, knew not only how to collect and consume what was grown in *Nature* but also knew how to make things grow. They played the role of preservers and creators because they knew they could not replace what they destroyed. How could creators destroy something that took millions of years to grow? The producers of life, therefore, rightly became the real saviours. (Even today, Chipko movement was started by Amrita Devi a woman).

Survival of forests/mankind has been due more to women - the collector than to man the hunter/destroyer.

From times immemorial there has been great regard and respect for both animal and forest life in India. The *Aranya Saṅskṛti* was not primitiveness but one of conscious choice. According to Rabindranath Tagore, the distinctiveness of the Indian culture consists in its having been defined life in the forest as the highest form of cultural evolution.

Indian's ancients had traditionally recognised the dependence of human survival on the existence of forests. They knew the importance of forestry. In the past there used to be small village forests attached practically to every village or groups of villages. These forests used to meet the requirements of the villagers in respect of firewood, small timber, grass, fruits and seeds. They did not have to go to cities/towns for employment or livelihood. They had no fear of degenerating/crippling the village economy. These patches of forests used to provide such raw materials as leaves for (plates), seed for oil extraction, small wood for fuel, small timber for toys and furniture, bamboo for basket, leaf for fodder, root and fruit for various purposes. The cattle population too was taken care of.

These forests prevented soil erosion and therefore, helped retain fertility. Such forest areas helped towards extension of agriculture. The ancients definitely knew the art and science of cultivation of the soil, the breeding and raising livestock.

They were wellversed in the science of agrobiolgy. Their scientific knowledge and observation of the plant kingdom is evident from such terms as *vṛkṣāyurveda*, *vanaspati-vidyā* and *aranyakas* (ancient texts).

Their science of forests did not perceive trees, as just wood but they knew their multifunctional nature. They knew how Nature always extended indication to serve and protect the man and his environment and his requirements. Through *Āyurveda* they utilised the plant wealth for the welfare of man.

A systematic knowledge about plants and forest ecosystems was thus generated and informal principles of forest management were formulated.

Vegetation was divided into various categories - *Vanaspati* (Fruit bearing), *Vanaspatya* (fruit and flower-) *Virudhi* (Shrubs) *Oṣadhi* (die after ripening).

Scattered village forests, easy reach of canal system, the use of trees as biological pumps, checked both water logging and alkali formation. Raising village forests as a stand-by during famines helped in prevention of pollution and floods. Such forests created a habitation for birds and small wild life. This also increased underground water resources.

Their agronomy or application of scientific principle to cultivation of land also helped in creating a general convention among people that everyone cutting a tree should plant another in its place.

A natural system of conservancy was in vogue. Almost every hill-top was dedicated to some local deity and the trees.

Sacred forests and sacred groves were created and maintained throughout India as a cultural response for their protection. Festivals in celebration of seasons or a culmination of the farmers hopes and achievements, like harvest festivals, festivals welcoming spring, rains, also show how India's religion and culture were rooted in forests, not through fear, nor because of ignorance, but through ecological insight and foresight.

The techniques, principles and methods on which India's agri- culture rested were varied in nature depending on the nature of the soil and the crop. But though varied they were almost primitively simple, retaining almost a static pattern a man, a pair of animals and a few simple villagemade tools that the soil required.

The actual success of agriculture in India largely depended on Nature. Overpopultaion had not then created land hunger among the people. Village industries kept a great part of the population engaged in fruitful economic pursuits. A proper balance between women and Nature, Nature and forest and

forest and agriculture kept the general economic conditions above the subsistence level. They had no technology which back-fired, no unmanagable wastes piling, no bio-degradable threats to eco-system, no radio-activity from explosions of nuclear weapons or installations, no over-cropping no overgrazing, no overlapping and no political economy of commodity and cash flows destroying natural cycles.

India's best ideas have come from man's communion with trees, rivers and lakes and Nature. The peace of the forest has helped the intellectual evolution of man. The culture of the forest fuelled the culture of Indian society says Tagore in Tapovan.

It does not call for conferences on ecological issues to save our forests, agriculture or our planet. Individual efforts can collectively usher in a healthy world. Our ancients knew the art and had the skill of taking a small step but the right step forward for us because they were committed environmentalists and friends of the earth.

They have saved the Earth by saving the forests. Isn't it our duty to save the Earth for our posterity? So let us resurrect our *Forests to Rejuvenate Our Agriculture*.

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पाणिनीये प्रतिफलितं प्राचीन भारतीय कृषिशाल्रम् (Agriculture in Pāṇini)

डॉ. गं. के. गुर्जर

कृषिशाल्राविषयाणि वाङ्मय स्रोतांसि

पाणिनीये प्रतिफलित प्राचीन भारतीयं कृषिशाल्रम्।

भारतेस्मिन् बहुतिथात्कालात् कृषिशाल्रं प्रगतम् आसीद् इति नास्ति तिरोहितं विदुषाम्। कृषिविषयां सामग्रीं प्रस्तुवन्ति भूयांसि वाङ्मयस्रोतांसि पुराणेतिहास-कौटलीयार्थशाल्र वराहामिहिरचितबृहत्संहिता सोमेश्वर विरचित मानसोल्लास शाङ्गधर पद्धतिगतोपवनाविनोदाः इत्येवमादिव्याजेन विख्यातानि वर्तन्ते। विद्वद्भिरपि एषां संशोधन सम्पादन पुरस्सरं परिचय सामान्याध्येतृणां कृते व्यधार्थं खलु। दिवंगतेन परमविदुषा भारतीय संस्कृतेःमूलशोधन मूल्याङ्कनादि कर्माणि निरन्तर व्यापृतचेतसा श्रीमता वासुदेवशरण आग्रवालेन विरचिते पाणिनिकालीन भारत वर्षनाम्नि प्रसिद्धग्रन्थे पाणिनीये व्याकरणं ऽपि कृषिविषयक विज्ञानपरा सामग्रीं सविवरणं प्राकाश्य नीताऽस्ति।

एवं प्राचीने भूते कृषिविज्ञानपरवाङ्मयस्रोतसां बाहुल्यं हशोरातिथ्यं करोतीति अमाकुलमतयो दुर्भिनिवेशरहिता ऐतिहासिका जनान्त्येव।

वैयाकरणस्य सर्वस्पृग्हक्

परमस्मिन् निबन्धे मया पाणिनीये व्याकरणे प्रतिफलितं प्राचीन भारतीय कृषिविज्ञानमेव भवाद्दशां विदुषां पुरत उपस्थापयिष्यते। तत्रभवान् भगवान् पाणिनिः। दर्भपवित्रपाणिः प्राङ्मुख उपविश्य महता प्रयत्नेन सूत्राणि प्राणिनाय यानिच संपिण्डीवृत्तानि अष्टाध्यायीतिनाम्ना ख्यातिप्रापुः। सूत्रकारस्य भगवतः पाणिनेः अष्टाध्यायीग्रन्थे वार्तिककृता वररुचिना उक्तानुक्त दुरुक्तचिन्तापराणि वार्तिकानि रचितानि सन्ति। तत्र सूक्ष्मोक्षिकया सारजिघृक्षया असारपरिचिहीर्षयया च प्रेरितो भगवान् भाष्यकारः पतञ्जलिः महाभाष्यं व्यरीरचत्। एवं त्रिमुनि व्याकरणं जेगीयते।

महाभारतस्य उद्योगपर्वणि समागतस्य सनत्सुजातीयस्य कश्चित् श्लोकः ~~वैयाकरणस्य~~ महिमानं विशदयैस्तदीया सर्वस्पृशं दृशं वर्णयामास। तद्यथा -

सर्वार्थानां व्याकरणाद् वैयाकरण उच्यते।

प्रत्यीदर्शी लोकानां तत्त्वदर्शी भवेन्नरः॥

कचित् सर्वदर्शीतिपाठोऽपि लभ्यते।

पाणिनिः प्राचाम् उदीचां जनपदानि ग्रामनगराणिच निजसंचारपूतानि कृत्वा सर्वेषां लोकानां समग्रं वागव्यवहारं प्रत्यक्षीकृत्य नैजम् अष्टाध्यायीग्रन्थं सूत्रात्मकं सर्वार्थविवरणपरं रचयामास। तत्र कृषिविज्ञानं कथमिव अतद्बद्धावकाशं भवेत्। अत इदं युक्तिपूर्वकं सुवचं यत् पाणिनीये व्याकरणे तदानीं तमं कृषिविज्ञानं पदसंग्रहव्याजेन सुरक्षितं वरीवर्ति। अपरं च वैयाकरणनिकाये निम्ननिर्दिष्टा कर्णगोचरी भवति।

अष्टाध्यायी जगन्माता अमरो जगतः पिता।

एवं परम्परीणसंस्कृत व्याकरण परिशीलिनाम् अस्माकं मातापितरौ जोधुष्येते इति सर्वजनप्रतिपन्नं खलु। अंतः अष्टाध्याय्यां या कृषिविज्ञानपरं पदसामग्री नयनगोचरीभवति सैव अमरसिंहेन स्वस्य अमरकोषे पातञ्जलं महाभाष्यम् उपजीव्य पिण्डिता खलु इत्यपि विदुषां नातिरोहितम्। अतएव बौद्ध धर्मानुयायिनः अमरसिंहस्य पातञ्जलमहाभाष्यगत-पदसामग्रीस्तेयं कोषरचनारूपप्रायं निरूपयन्ती एका निम्नलक्षिता अभियुक्तेक्तिः नितरां संगच्छते-

अमरसिंहो हि पापीयान् सर्वं भाष्यमचचुर्नु।

उदाहरणनिमित्तं किञ्चिददत्र लिख्यते॥

आयुर्वेदे निघण्टुग्रन्थे वनस्पत्योषधिरिव्य गुणनामवर्णनपरा अतीव प्रसिद्धः सन्ति। तत्र ओषधीनां वर्गशो वर्णनम् उपलभ्यते। परं सर्वत्र आदिमो वर्गो हरीतक्यादिरेव पठ्यते। अमरोऽपि 'हरीतक्यादयः स्त्रियाम्' इति निर्दिष्टः। तत्र 'हरीतक्यादिश्च' (अ. ४-३-१६७) हरीतक्यादिषु व्यक्तिः (वा. १-२-५२) लुपि युक्तवद् व्यक्तिवचने

(अ. १-२-५१) इति पाणिनीय सूत्रानुसारेणा सभ्यः प्रतीयते। अमरः अग्रेऽपि उदाजहार—

पुष्पे जातिप्रभृतयः स्वालिल्ला ब्रीह्यः फले।

विदार्याधास्तु मूलेऽपि पुष्पे क्लीबेऽपि पाटल॥

अमरः २-७-१९

औषध्यो जातिमात्रे स्युः अजातौ सर्वमौषधम्। तत्र औषधशब्दः 'औषधेरजातौ' अ. ५-४-३७ इत्यनेन पाणिनीय सूत्रेण अणप्रत्ययपूर्वक निष्पादितो वर्तते।

शाकाख्यं पत्रपुष्पादि तण्डुलीयोऽल्पामारिषः।

अमर २-४-१३५

अत्र 'तण्डुलाय हितः' इत्यर्थे 'तस्मै हितम्' इति छप्रत्ययविधानान् तण्डुलीय शब्दः सिद्ध्यति।

पाणिनीया पञ्चपाठी

कृषिविज्ञानस्य पाणिनीय पञ्चपाठ्यां कथाचिन्मात्रया प्रतिफलनम् अववश्यंभावि, वैयाकरणस्य सर्वार्थविवरण रूपव्याकरणपरत्वात्। वैयाकरणा लक्ष्यैकचक्षुष्का जेगीयन्ते। लक्ष्याणि नाम पदसाधुत्व धर्मिकोदाहरणानि। व्याकरणं च लक्ष्यलक्षणं प्रसिद्ध्यति। अल्लेण सूत्रपाठमगी पाणिनीया चतुष्पाठी जोधुष्यते। तत्र वार्तिकपाठः गणपाठः उणादिपाठः धातुपाठश्चेति चतुष्पाठी सूत्रपाठमन्तर्भाव्य पञ्चपाठी भवति।

इदानीं सूत्रपाठमाधृत्य किञ्चित्प्रतिपाद्यते। तस्य वापः (अ ५-१-४५) उप्यते बीजारोपणं क्रियते अस्मिन्निति वापः क्षेत्रम्। प्रस्थनामकस्य परिमाणस्य वापः प्रास्थिकम्, द्रौणिकम्, खारीकम्। अत्र प्रस्थं द्रोणखारी पणिमाणानुसारेण यस्मिन् क्षेत्रे बीजावापः क्रियते, तादृक् क्षेत्रं प्रास्थिक द्रौणखारीक पदव्यपदेश्यं भवति।

कृषिविज्ञाने पाशुपाल्यं निरतिशयं महत्त्वं बिभर्ति। गवां नियंत्रणे परिसाने साहायक विदधानं कडंकरं नाम माषमुद्गादिकाष्टमर्हतीति कडंकी यो गौः। येच वृक्षाः छिन्नप्ररुढा भवन्ति तत्र 'छेदादिभ्यो नित्यम्' (अ. ५-१-६४) इति ते छेदं नित्यम् अर्हन्तः छेदिका उच्यन्ते।

ये तण्डुलाः पाकयोग्याः सन्ति ते 'स्थलीबिलात्' सूत्रेण (अ. ५-१-७०) स्थालीबिलमर्हन्तीति स्थालीबिलीयास्तण्डुलाः। विभाषया स्थालीबिल्या अपि यत्प्रत्ययविधानात्।

पाशुपाल्येऽपि आगवीन अनुगवीनशब्दौ सविशेषं लक्षणीयौ। तत्र (अ. ५-१-१४) सूत्रेण आगवीन्ते निपातितः अनुगवीनश्च 'अनुगु अलङ्गामी' सूत्रेण अनुगु गोःपश्चात् पर्याप्तं गच्छति ताम् अवेक्षमाणः अनुगवीनो गोपालः।

गवां स्थानं गोष्ठेतिप्रातिपदिकेन ख्याप्यते। तत्र यो भूतपूर्वो गोष्ठः तदुपलक्षितो देशो वा 'गोष्ठ्यात्वञ्भूत पूर्व' अ. ५-२-१८ सूत्रेण खञ्प्रत्यय विधानाद् गौष्ठीन इति व्यपदिश्यते। अमरोऽपि आह—गौष्ठीनिं भूतपूर्वकम्।

विविधानि धान्यानि क्षेत्रेषु उप्यन्ते स्म। उप्यमानधान्यनामानुसारेण क्षेत्राण्यपि तत्तद्धान्यनामांकितानि भवन्ति स्म। अस्मिन् विषये सूत्रचतुष्टयं निर्देश्यं भवति।

धान्यानां भवने क्षेत्रे खञ् । अ ५-२-१

ब्रीहिशाल्योर्ढक्। अ ५-२-३ ब्रैहेयम्, शालेयम् यवयवकषट्टिकाद्यत् अ ५-२-३ यवानां भवनं क्षेत्रं यव्यं यवक्यम्, षट्टिक्यम्। अतो यस्मिन् क्षेत्रे षट्टिका उप्यन्ते प्ररोहन्ति च तत् षट्टिक्यमिति निर्दिश्यते।

पाक्षिक खञ्प्रत्ययविधानात् तिल्यं तैलीनम्, माष्यं माषीणम्, उम्यम् औमीनम्, भङ्ग्यं भाङ्गीनम् इति विभाषा तिलमाषोमाभङ्गारुभ्यः अ ५-२-४ सूत्रेण व्युत्पाद्यं भविता

अधुना 'अहल्यायै जारः' इति प्रसिद्धे शतपथब्राह्मणवाक्ये पाणिनीयानुसारेण विचार्यते। हलेन कर्षम् अर्हति इति हल्या भूः। ताहशी भूमिः हलकृष्टा सती हल्या इत्युच्यते। या तादृशी न भवति सा अहल्या भूमिः। देवो वर्षति, इन्द्रो वर्षति इति पातंजलभाष्याद् इन्द्रः खतु पर्जन्यदेवता। सच भूयः वर्षन्नापि हलकर्षणहीना भूमिं न कक्षमपि अनुगृह्णाति, हलकृष्टां च हल्यां भूमिं हल्यं क्षेत्रं वा वृष्ट्या अभ्युपपद्येत इति सत्यम्। परं दयानन्दसरस्वतीमहाभोगेन ऋग्वेदादिभाष्यभूमिकायाम् इदं ब्राह्मणवाक्यम् अन्यथा व्याख्यायि।

उणादयो बहुलम्

'उणादयो बहुलम्' इति पाणिनिना सूचितम्। उपादिपाठः पञ्चभिः पादैः क्वचिद् दशाभिः पादैश्च समाप्यते। तत्र पञ्चपादोपेतः उणादिपाठः उज्ज्वलदत्तेन वंगीयेन वाराणसेयेन भट्टाजिदीक्षितेन च स्वीकृतो वर्तते। ननु किमयम् उणादिपाठः पाणिनीयः शाकटायनीयो वा इत्यत्र विद्वांसं विप्रतिपद्यन्ते। परं तत्रेदमवधेयं यद् 'उत्तरोत्तरं मुनीनां प्रामाण्यम्' इति परमप्रामाणिको भगवान् भाष्यकारः पतंजलि बहुत्र औणादिदक प्रतिपादिका सिद्धिं प्रतिपादयामास विशेषतः स्वरविधाने। अन्यत्र उणादिपाठस्य शाकटायनकर्तृकत्वं तेन 'नामच धातुजमाह निरुक्ते व्याकरणे ष शाकटस्य च तोकम् इति 'शाकटस्य तोकम्' निर्देशपुरस्सरं सोपहासं लक्षितं खलु। भावप्रधानम् आख्यातम् सत्वप्रधानि ना भानि इति यद् यास्काचार्यो निरुक्ते निर्दिदेश तदत्र पाणिनीये उणादिपाठसमावेशेन प्रमाणितार्थं लक्ष्यते। अतोऽनया दशा औणादिकानि प्रतिपदिकानि व्युत्पन्नानि सिष्याति। अपरे तु उणादीनि अव्युत्पन्नानि नामानि आहुः। परम् अद्य वैदिको दायः परम्परां रक्षितुकामेन पञ्चपाठ्यां समावेशितः पाणिनिना इति सुविभावनम्।

कानिचिद् उदाहरणानि

वप्रः प्राकारार्थः प्रसिद्धः। परं क्षेत्रार्थे दशपाद्यां सुष्ठु कीर्तितः। 'वृधिवपिभ्यारन्' रन्प्रत्ययान्तः; 'दुवध् बीजसंताने इति भौवादिकाद्धातोः व्युत्पाद्यते। उप्यते बीजम् आरोप्यते आस्मिन्निति वप्रम्।

छदिः 'कर्चिशुचि' इत्यादिना 'छद अपवारणे' चौरादिकाद्धातोः इसिप्रत्ययविधानेन पटलार्थे व्युत्पादितः। छदिषे नाम पटलाय गृहाच्छादनाय हितानि तृणानि छादिषेयाणि उच्यन्ते।

वृक्षः 'ओत्रच्छू छेदने' वृच्छति छिनत्ति दूरीकरोति आतपम् इति वृक्षः, उज्ज्वल उ ३-६६

पूत्रः 'छापूखडिभ्यः कित्' ३११२३

'पूत्र पवने' अस्मान् गन्प्रत्ययः सच किद् भवति। पूयते मुखमनेनति पूत्रः गुवाकः क्रमुकम्

मूलम् : 'मूशक्यविभ्यः क्लः' ३-४-१०८

'मूडा बन्धने' अतः क्लप्रत्ययः। मूलं बुध्नः उज्ज्वल तदत्तः मूलं प्रतिष्ठा, हेतुः दशपाद्यां ४-११९

एवं पाणिनीये प्रतिफलितं प्राचीनभारतीय कृषिविज्ञानं नाति विस्तरेण मया निबन्धेऽस्मिन् प्रत्यपादि। अष्टाध्याय्याः संहिताग्रंथसांनिभत्वात् प्रमाणिकत्वेन अत्र संरक्षिता कृषिविज्ञानविषया प्रतिपदिक शब्दसामग्री नितरां प्रमाणभूता भवितुमर्हति। तद् दिङ्मात्रं दर्शितमस्ति।

आकर ग्रन्थस्य सूत्रात्मकत्वात् प्रतिपादने सौकर्यं वर्तते। तत्रापि भवाह क्षैः गुणैकपक्षपातिभिः द्वारिषधैः विद्वन्दिः क्षन्तव्यमत्रत्यं कठिन्यमिति अभ्यर्थ्य अत्रभवद्भ्यः धन्यवादान् कितीर्य विरमामीति शम्।

भारतीय शिल्पातील बैलगाडी

प्र. रा. अहिरराव

प्राचीन भारतीय उपखंडातील शेतीचा मागोवा घेताना असे लक्षात येते की, बैलगाडीला फार महत्त्व आहे. अति प्राचीन काळापासून ते आजच्या अति जलद युगातही बैलगाडीचे अस्तित्व टिकून आहे. मोठ्या शहरांत ती आढळते तसेच खेड्यातील दळणवळण आजही बैलगाडीवर अवलंबून आहे. अशा या बैलगाडीच्या इतिहासाचा मागोवा घ्यावयाचा आहे. यासाठी शिल्प हा मुख्य आधार घेतला आहे. म्हणून मी माझ्या निबंधास 'भारतीय शिल्पातील बैलगाडी' हे शिर्षक दिले आहे.

पहिला प्रश्न मानवाला हा शोध कसा लागला व तो केव्हा लागला ? प्राथमिक अवस्थेत मानव जेव्हा या प्रचंड निसर्गशक्तीशी झगडत आपले अस्तित्व टिकाविण्यासाठी लांबून काही वस्तू आणत असे, ती वस्तू तो आपल्या डोक्यावर किंवा हातात घेवून वाहत असे. याकाळाला शास्त्रज्ञांनी डोक्यावर वाहून नेण्याला काळ असे नामविधान केले आहे. या नंतर मानवाने काही प्राण्यांना आपलेसे करून घेतले व त्यांच्याकडून आपली कामे करून घ्यावयास प्रारंभ केला. त्याने आपल्या डोक्यावरील बोझा प्राण्याच्या पाठीवर लादण्यास सुरुवात केली. या घटनेचा काळ ठरविण्याचा प्रयत्न काही शास्त्रज्ञांनी केला. त्याविषयी अनेक वादाचे मुद्दे निर्माण होण्याची शक्यता आहे. येथे तो आपला विषय नाही. भार वाहण्यासाठी भारतात कोणता प्राणी प्रथम वापरला गेला याबद्दल शास्त्रज्ञांत मतभेद आहेत व तसे निश्चित सांगणे कठीण आहे. घोडा खेच - गाढव याचा उपयोग साधारणतः इ.स. पूर्व १५४० पूर्वीचा पुरावा आढळत नाही परंतु नांदुरा,

अमरी व कुर्ला येथिल उल्मनात सांपडलेल्या मातीच्या भांड्यांवर मात्र बैलाचे चित्र आढळते. या चित्रात बैलाच्या पाठीवर भार चार्हून नेतांना रेखाटले आहे. यावरूनतरी भारतात सर्वात प्रथम बैल हा प्राणी उपयोग आणला असावा असा शास्त्रज्ञांचा दावा आहे.

इतर प्राण्यापेक्षा मानवाला बुद्धि अधिक असल्यामुळे त्याने प्राणी आणि आपल्या शक्तीचा अधिकाधिक उपयोग करून घेण्यासाठी तांत्रिक योजना राबविण्याची ठरविले. त्याच्या असे लक्ष्यत आले की, अशी तांत्रिक योजना केली तर वाहण्याचे काम अधिक सुखद होईल. त्याच्या मनात ही कल्पना आल्यावर त्याने प्रथम एका सपाट वस्तूवर बोझा ठेवला तर ओढण्यास किंवा वाहाण्यास सोपा पडतो असे आढळून आले. ब्रिटानिका विश्वकोशांनुसार पहिल्या गाडीस चाक नव्हते. नंतर या वस्तूच्या खाली काही गोल लाकडे ठेवल्यास व त्यावरून सरकत नेली तर कमी श्रम पडतात असे अनुभवास आले. या साऱ्या अनुभवाचा फायदा घेता निरीक्षण करतांना या गोल लाकडाच्या जागी चाक आले या रूपांतरातच बैलगाडीचा जन्म झाला.

पृथ्वीवरील पहिले चाक फिरले ते युफ्रेटिस आणि टायग्रिस या भूमींवर असे तज्ञांचे मत आहे. त्याचा काळ साधारणतः इ. स. पूर्व तीन हजार वर्षे असा धरला जातो. हा काळ ज्या भूमीवर सापडलेले पुरावे याच्या आधारावर हे ठरविला आहे. त्यानंतर अनेक संशोधन झाले. त्यातून पुरावे मिळाले मग मागील संशोधनाचा निर्णय बदलू लागला.

कै. डॉ. व्ही. एस्. वाकणकर यांनी मध्यप्रदेशातील भीमबेटका येथिल शैलचित्रांचा अभ्यास पूर्ण केला व काही वर्षांपूर्वी त्यांनी या शैलचित्रांचा काळ निश्चित केला व तो जगन्मान्य करून घेतला. दुर्दैव असे की त्याचा ह्या कालखंडाचा पुरावा अजूनहि शास्त्रज्ञ हवा. तसा संदर्भात घेत नाहीत.

या शैलचित्रांचा काळ इ. स. पूर्व २०,००० ते १०,००० असा दरविला आहे व ही शैलचित्रे जगातील सर्वात प्राचीन शैलचित्रात मानली गेली. अशा या शैलचित्रात आजचा आपला जो विषय आहे ती बैलगाडी रेखांकित केली आहे ती उदत्या रथाच्या रूपात.

या बैलगाडीला दोन चाके दाखविली असून त्या चाकांना आठ अऱ्या स्पष्ट दिसतात. ही दोन्ही चाके एका आसांत जोडली असून गाडीवान उभा राहून गाडी हाकीव आहे. रेखांकित प्राणी गाडीला जुंपले आहेत ते बहुदा बैल असावेत असे वाटते. कारण त्याच्याजवळ अनेक बैलहि चित्रित केले आहेत. सर्वात विशेष हे आहे की, शेतकरी आपले औत जुंपून शेतीची मशागत

करीत असलेली चित्रेहि आहेत. या रेखांकित बैल शिंगांचा आकार हल्लीच्या भारतीय बैला प्रमाणे आहेत व ते विविध आहेत. प्राचीन शिल्पांत मोठ्या वाशोडांचे वैशिष्ट्यहि येथे दिसून येते. ही गोष्ट लक्षात ठेवण्यासारखी आहे. बैलगाडीला एका ठिकाणी बैलाऐवजी हरीण जंपुले आहे. जगातील शास्त्रज्ञांच्या मते युफ्रेटिस मध्ये इ.स.पूर्व ३००० वर्षी पहिले चाक फिल्ले तर आता भारतीय भूमीत इस. १७००० वर्षापूर्वीच बैलगाडीचे चित्र काय दर्शविते? मग जगातील पहिले चाक व बैलगाडी कोणत्या भूमीवर धावली याचा विचार आपण करावयास हवा व तसे मान्य करावयास हवे असे मला वाटते. कै. वाकणकरांना आपल्या संशोधनाचा परिणाम स्वतंत्र मांडण्यास अवसर मिळाला नाही हे दुर्दैव. भारतीय बैलगाडीचे हे चित्र सर्वात प्राचीन मानावयास हरकत नाही. या समूहातील बैलगाडीचे विविध नमुने आपणास पहावयास मिळतील. यात युद्धोपयोगी बैलगाडी आहे. नंतरच्या काळात त्याला रथ ही संज्ञा मिळाली. येथील समूहात दोन दित्रात आपल्या हत्यारासह (युद्ध) रणभूमीकडे शिकारिसाठी कूच करताना दिसत आहे; त्याचा सारथी आपला रथ हाकतांना दिसत आहे. या वेळी डॉ.व्ही. व्ही. राव यांनी द्वाकेंचा काळ ठरविला आहे त्याची आठवण होते व त्याकाळी रथ इतका प्रगत असण्याची शक्यता अधिक दृढ होते, ती या शैलचित्राच्या काळावरून.

प्रागैतिहासिक काळातील मेडोरी येथील बैलगाडीचे रेखांकन एक वेगळेच वैशिष्ट्य दाखवून जाते त्याचे हे चित्र पाहिल्यावर आपल्या लक्षात येईल. बैलगाडीचे सर्वच विभाग स्पष्ट दिसतात.

शैलचित्राच्या काळानंतर मध्ये बरेच अंतर आहे. त्या काळातील उदाहरणे सापडत नाहीत. नंतर सापडलेल्या सर्वात प्राचीन संस्कृति म्हणजे मोहोत-जो-दाडो हडप्पा संस्कृति. या संस्कृतिचा काळ व युफ्रेटिस येथील संस्कृतीचा काळ जवळ जवळ सारखा आहे. या दोन्ही ठिकाणी बैलगाडी आढळल्या आहेत. तेव्हा या दोन्ही संस्कृतिपैकी कोणी शोध अगोदर लावला या विषयी डॉ. बलराम श्रीवास्तव संभ्रमत आहेत. ते म्हणतात या दोन्ही पैकी कोणी तरी एकाने शोध लावला असेल व नंतर आपसात देवाण घेवाण केली असेल तर डॉ. जान मार्शल हडप्पा या ठिकाणी सापडलेली बैलगाडी भारतातील सर्वात प्राचीन म्हणतात; श्री. डब्ल्यू. एल. मुरेल्ड इ. स. पूर्व १५०० साली असिरियन, ग्रीक व रोमन बैलगाडी प्राचीन असे प्रतिपादन करतात. या सर्व शास्त्रज्ञांनी शैलचित्रांचा विचार केलाच नाही. कारण त्यांच्या पुढे त्यावेळी या शैलचित्रांचा काल निश्चित झाला नव्हता किंवा त्यांनी त्या शैलाचित्रांना फार अलिकडचा काळ दिला होता. तर हल्लीचे शास्त्रज्ञ हे सारं खोडून नवीन अनुमान मांडण्यास अजून धजावत नाही.

सिंधु खोऱ्यात इ. स. पूर्व २००० च्या सुमार मानल्या गेलेल्या संस्कृतिताहि बैल जुपलेल्या दोन चाकी व चार चाकी बैलगाड्या आढळल्या आहेत. युक्रेटिस व सिंध खोऱ्यात या बैलगाड्या सापडलेल्या आहेत. मग बैलगाडीचा शोध कोणी लावला याचे स्पष्ट अुतर देणे टाळतात किंवा जर तर ची भाषा सुरु करतात. श्री. नलराम श्रीवास्तव म्हणतात या दोन संस्कृतीनी या ज्ञानाची कोणी कोणाकडून अुसनवारी केली हे सांगता येत नाही. परंतु हडप्पा येथे सांपडलेली बैलगाडी मात्र संपूर्ण भारतीय आहे व येथेच विकसीत झाली आहे असे म्हणता येईल या वरून असे अनुमान काढल तर वावग होणार नाही.

युक्रेटिस संस्कृतिला मागील पुरावा किंवा पंरपा दिसत नाही असे दिसते. तर येथे रामायण - महाभारत व भीमबेटका यांचा संदर्भ किंवा पंरपा दिसते किंवा मिळते. युक्रेटिस किंवा सिंधु संस्कृतिनी आपआपल्या परिने ही कला विकसित केली असामी असं म्हणावयास हरकत नाही. काळाच्या बद्दल मात्र भारतीय संस्कृति ही अधिक वयस्कर आहे यात शंका नाही. म्हणून असं म्हणता येईल की, जगातील पहिले चाक हे भारतीय भूमिवर फिलेले.

या नंतर येणाऱ्या हडप्पा आणि सुमेरियन येथिल बैलगाड्याकडे पाहिले तर एक लक्षात येईल की, या दोहो संस्कृतीची प्रगति ही वर सांगितल्या प्रमाणेच स्वतंत्र झाली, कारण सुमेरियन बैलगाडी (रथ) ही युद्धोपयोगी वाटते. तर हडप्पाची बैलगाडीही सामान्य अुपयोगसाठी वाटते. हडप्पा या ठिकाणी एकाहि युद्धोपयोगी बैलगाडी सापडत नाही. आपल्या लक्षात येईल उलट भीमबेटकाच्या शैलचित्रात युद्ध व सामान्य अुपयोगी दोन्ही प्रकारच्या बैलगाडी आढळतात. येथिल बैलगाड्या युद्धोपयोगी म्हणण्यापेक्षा आपल्या उदरनिर्वाहासाठी व शिकारिकरिता असतील असं म्हणण अधिक सयुक्तिक वाटते. शिकारीसाठी हे लोक बैलगाडीवर जात असतील असं अनुमान काढावयास हरकत नाही. पण प्रत्यक्ष शिकारीची चित्रे आहेत त्या ठिकाणी मात्र बैलगाडी दिसत नाही.

वाड्मयीन पुरावा पाहता असें दिसून येईल की, भारताच्या सर्वात प्राचीन वेद- वाड्मयातच या विषयी सविस्तर चर्चा येते. ऋग्वेदातील तिसऱ्या मंडलाच्या ५३व्या सूक्तामध्ये आपल्या रथाचे व त्याच्या इतर भागासह त्याचे रक्षण कर असे म्हटले आहे. इतर ठिकाणाच्या वर्णनावरून या काळातील लोकांना बैलगाडी किंवा रथ पूर्णपणे ज्ञात होता. या नंतर येणाऱ्या संस्कृतसाहित्यातहि संदर्भ सापडतात. शकट हा शब्द बैलगाडीला वापरलेला आढळतो. तो वैदिकवाड्मयात कमी दिसतो. नंतरच्या काळात मात्र सतत आढळतो. शिवाय बौद्धवाड्मयातही विशेषतः 'जातककथा' मध्ये अधिक आढळतो. रथ हा वैदिक काळात लोकप्रिय असला तरी त्याचा अुपयोग फक्त युद्धकाळातच होत होता असे दिसते.

मालवाहतूकसाठी मात्र अनास आणि शकट वापरीत असत. याला बैल जुंपत असत. आदवाह असेही नामविधान काही ठिकाणी सापडते; वाह याचा अर्थ बैल असाहि होतो. अनास हे खैर किंवा सिसमच्या लाकडापासून बनवीत असत.

ऋग्वेदात लग्न सोहळ्यातील वर्णनांत नववधुला घेवून जाणाऱ्या पांडन्याशुभ्र बैलांच्या गाडीचे वर्णन केले आहे. नववधु निघण्यापूर्वी गाडीच्या चाकावर तूप ओतून फुले व झाडाच्या फांद्यांनी पूजा करते असं वर्णन पुढे दिले आहे.

आता आपण भारतीय शिल्पातील रंगे व तिचे बनावटीकडे व तिच्या कांही भागाबद्दल विचार केला तर आज वापरांत असलेली बैलगाडी व दोन अडीच हजार वर्षापूर्वीच्या बैलगाडी मध्ये फारसा फरक आढळत नाही. हेच प्राचीन भारतीय बैलगाडीचे विशेष आहे. कालबिगान येथिल उत्खननात शेतीविषयी अधिक माहिती अुजेडात आली. येथे सापडलेल्या बैलगाडीच्या दोन चाकातील अंतर व आजच्या प्रागत बैलगाडीच्या दोन चाकातील अंतरात फक्त एक इंचापेक्षा कमी फरक आढळतो. या वरून प्राचीन शेतकऱ्यांच्या तंत्राच्या विकासाविषयी कल्पना येते. अरी - आस - डूसू व बू विषयी असेच म्हणता येईल.

सिंधु खोऱ्यातील बैलगाड्यांच्या काळ इ. स. पूर्व दोन - तीन शतक असा थाला जातो. बैलगाडीचा आस हा चाकाच्या मध्ये फसविलेला आहे. गाडीचा साठा हा दोन वक्र दांड्यावर आहे व त्याला दोन ते चार आडवे बांबू लावले आहेत.

हडप्पा संस्कृतीतील चंद्रगहो येथिल बैलगाडीची बांधणी फार साध्या पद्धतीची आहे. ही गाडी तीन मजबूत तुकड्याची एकात एक अडकवून केली आहे. त्यातील बरेच नमुने अुपलब्ध आहेत. त्यातील कांही पाहिली म्हणजे लक्षात येईल की, तिचा साठा हा अुपयोगानुसार बांधलेला आढळतो. प्रवासी अथवा मालवाहतुक्साठी वेग वेगळा आकार दिला आहे.

हडप्पा संस्कृतीतील बैलगाडीचे चाक हे भरीव होते (सापडलेल्या प्रतिकृती या खेळण्याच्या आहेत.) आर्यांनी त्या चाकास आऱ्या तयार केल्या व बैलगाडी हलकी केली. हे प्रा. बलराम श्रीवास्तव यांचे म्हणणेहि विचित्र वाटते. कारण वैदिकपूर्वकाळातील दोन चाकाची बैलगाडी होती व तिला आरी असलेली चाके होती. चाकाच्या आऱ्या ह्या तुवाड्यांत फसविलेल्या असत. चाकावर धातूची धाव असे असा तर्क आहे असे तेच स्वतः इतर ठिकाणी संदर्भ देतात.

चित्र किंवा शिल्परूपाने इ. स. पूर्व १७००० ते इ. स. २०० पर्यंतचे बैलगाड्यांचे कांही प्रकार आज आपणांस ज्ञात आहेत. या वस्त्र बैलगाडीचा बदललेला नमुना किंवा पद्धत याचा अभ्यास करणे सोईचे झाले आहे. यातील काही प्रतिनिधिक प्रकार आपण पाहू.

मोहन-जो दडो-हरप्पा व चांदरो येथे सापडलेल्या या खेळण्यांतील बैलगाडी वस्त्र एक गोष्ट लक्षात येते त्या उपयोगात असलेल्या बैलगाड्यांच्या प्रतिकृति आहेत. त्या पाहिल्या तर आजहि सिंध-पंजाबातल्या वापरातील आढळून येतात. गाडीचे कठडे, साठे आजहि त्याच पद्धतीने तयार केलेले दिसतात. या भागातील शेतकरी आपल्या औजाराबाबत बराच प्रगत होता हे पूर्वी सांगितलेच आहे. त्या प्रमाणे तो दिसतो.

चाहु-रो हे हडप्पा पासून ४०० मैल दूर असले तरी येथे सापडलेली खेळणीत व हडप्पा येथील खेळण्यात विलक्षण साम्य आहे. या दोन्ही ठिकाणी एकच संस्कृति नांदत होती असे म्हणावयास हरकत नाही. त्यांनी आपल्या या प्रवासासाठी हीच वाहने वापरली असावीत. या गाड्यांच्या चाकानुसार तीन प्रकार दिसतात. या चाकावर प्राण्यांचे चित्र आहे दूर दक्षिणेत असलेल्या इनामांगव येथील चाकावर देखील असे चित्र आहेत. हेहि एका आश्चर्यकारक साम्य आढळून येते.

या गाडीचा सांगाडा अतिशय साधा असून दोन्ही बाजूस बांबू लावले आहेत. व एकच दांड्याची चू असून दोन बैल जुपलेले दाखविले आहेत. तर दुसऱ्या गाडीचा आकार काहीसा अर्धगोल असून त्यावरहि वेगवेगळ्या खुंचीचे बांबू लावले असून आसाला खिष्टी लावली आहे. यालाहि एकच दांडा आहे. मात्र येथे चू दिसत नाही तर दुसऱ्या गाडीला वरचा कठडा हा हौदप्रमाणे आहे व दांडा एकच आहे.

शुंग कलेतील ही बैलगाडी (इ. स. पूर्व २०० वर्षे) येथे अभिभव शांकुल मधील या दृष्यात चार घोड्यांचा रथ दर्शविला आहे.

वैशाली येथे मातीपासून बनवलेली कांही खेळणी सापडली आहेत. त्याची चाके इतकी कलात्मक बनवलेली आहेत. ते भक्ती असली तरी कलाकरांने तेथे आऱ्यांचा भास निर्माण केला आहे.

बारदुत शिल्पात बांबूच्या साह्याने बनवलेली बैलगाडी जेतवनाच्या आश्रमात दाखविली आहे. या गाडीची बांधणी अतिशय साळ आहे. दोन दांड्यांवर गाडीचा साठा असून तो बहुतेक लाकडी असावा. शिवाय दोन्ही दांडे जुंला जोडले आहेत. चाकास सहा आऱ्या आहेत. अति मात्र दिसत नाही. दुसरी

बैलगाडी मात्र गाडीवानाची जागा दिसते. दोन चाकांना मात्र सोळा आऱ्या आहेत. गाडीचा साठा चौकोनी आहे.

गोली येथे सांपडलेल्या या बैलगाडीस मात्र हल्लीच्या छकड्या सारखे छत आहे. असाच नमुना मथुरा येथे सापडतो. गोली येथिल छत आहे. असाच नमुना मथुरा येथे सापडतो. गोली येथिल छत गोल आहे तर मथूरा येथिल छताला थोडा ढाळ दिला आहे. इतर बैलगाड्यांना छत नाही; दोन्ही बाजूस कडडा दिसत आहे.

शकट ज्या बैलगाडीस म्हणतात ती सर्वसाधारण बैल जुंपतात 'महावर्ण'मध्ये दोन बैलाबरोबर गाथीहि जुंपल्याचे उदाहरण आहे. परंतु अनेक धर्मग्रंथांनी याचा निषेध दर्शविला आहे. पाणिनीच्या मतानुसार ज्याला दोन बैल जोडले जातात तिला शकट असे म्हणतात. 'महानिदेश' मध्ये सहा प्रकारचे यान सांगितले आहेत. पतंजलीने सांगितलेल्या प्रकारात गर्दभरथ सांगितला आहे. 'महाभारतात'हि स्वर्गयान चा उल्लेख आहे. गोली येथील शिल्पात दोन मानव गाडी ओढून नेतांना दिसतात. तर गांधर्व शिल्पांत मेंढयांची नजरेस दिसते. उंट व हत्ती गाडीस जुंपले जातात असं म्हटल जात; परंतु शिल्पातील उदाहरण मात्र सापडत नाही.

मथुरा कलेतील बैलगाड्या बऱ्याच सांपडतात. कंकाली टिल्यातील जैन स्तूपाच्या बीम वरील बैलगाड्या मध्ये घोडा-बैल जुंपलेले, माल व प्रवाशी वाहणारे अशा विविधप्रकारात, अनेक आऱ्यांमध्ये चाक दर्शविणारी, तसेच उघड्या व छत असलेल्या अशा गाड्या शिल्पांकित केल्या आहेत. या कलेचा काळ हा दुसरा / तिसरा शतक मानला जातो.

या नंतर (महाराष्ट्राकडे) वळू या. येथील उत्खननात सापडलेली कार्यांची बैलगाडीने आपल्या वैशिष्ट्यामुळे एक वेगळे स्थान मिळविले आहे. भरीव चाक असलेली व बैलाच्या पायाखाली पट्टी असलेल्या व गाडीवान अुभा असलेल्या या शिल्पाला खेळणी घरण्यात आले आहे. इनामगांव येथील या बैलगाडीचे वय ३२ शतकांचे आहे.

याहि पेशा अधिक कलापूर्ण असलेला रथ नगर जिल्ह्यात सापडलेला आहे. तो आज दिल्लीच्या राष्ट्रीय संग्रहालयात आहे. त्याचे छायाचित्र अपुलब्ध होऊ शकले नाही.

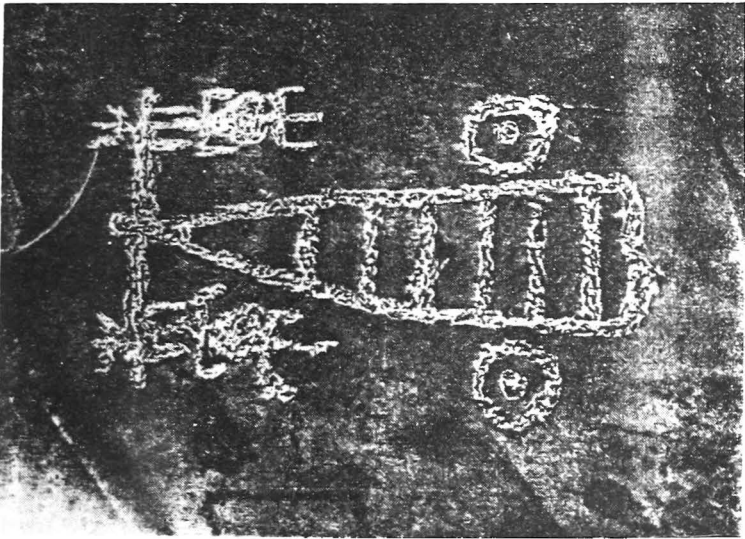
इ. स. २ऱ्या शतकातील घातूच्या दोन वैशिष्ट्यपूर्ण छत असलेल्या बैलगाड्या कोल्हापूर जिल्ह्यात ब्रह्मपूरी येथे सापडल्या आहेत. पहिल्या बैलगाडीचे कलापूर्ण चाक, तीन दांडे व गाडीवानाला बसण्याची जागा आहे तर दुसऱ्या बैलगाडीत

जू नसलेला एकच दांडा आहे. दुसऱ्या बैलगाडीत जू नसलेला एकच दांडा आहे. अशा या कलापूर्ण बैलगाड्या महाराष्ट्रात आजहि दिसतात.

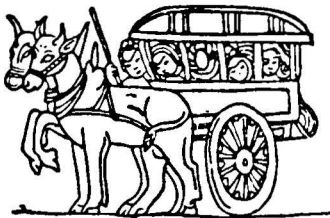
कर्नाटकांतील बेलवडगी येथील एका शिलालेखासह असलेल्या या गाडीला एकच बैल जुंपलेला असून दुसरा बाजूला उभा आहे व एक दांडा छत असलेली ही बैलगाडी आहे.

सांची येथील स्तूपामध्येहि रथाचे अनेक शिल्प आहेत. या घोडे जुंपलेले असून आज आपण जे रथाचे चित्र मनात आणतो त्या प्रकारात हे मोडतात.

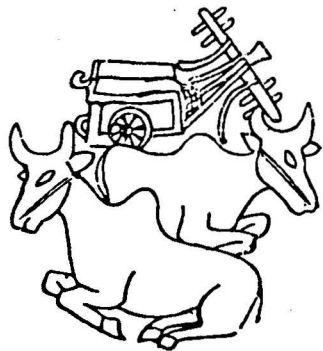
अमरावती (आंध्र) येथील स्तूपाचे अवशेष सांपडले आहेत. त्या ठिकाणीहि बैलगाडीने आपले अस्तित्व दाखविले आहे. एका ठिकाणी उघड्या कठड्याची माल भरलेली जू वर केलेली बैलगाडी आहे तर दुसऱ्या ठिकाणी युद्धातील (बैलगाडी) रथ दाखवला आहे. या दक्षिणेतील कृतीत उत्तरेकडील गाडीत कांही एक फरक दिसत नाही असं दिसते.



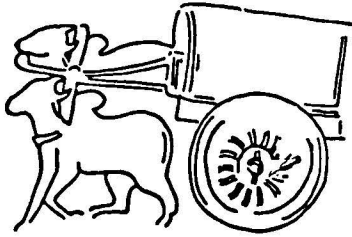
Bullock Cart Mandori



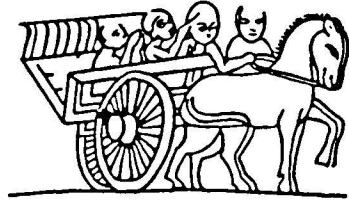
Bullock Cart-carrying persons



Bullocks resting with cart nearby



*Bullock Cart covered.
Spokes clearly seen.*



Horsedrawn Cart as carriage



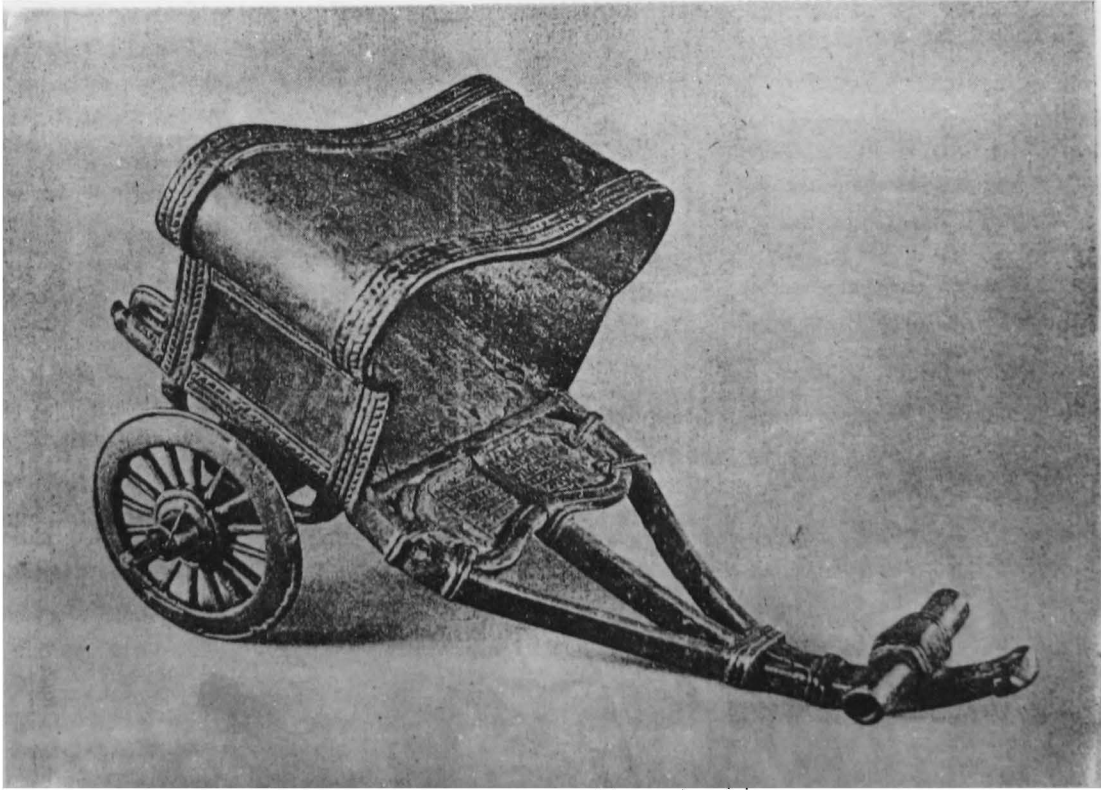
Covered Cart



Goatdriven Cart



Bullock Cart in Torna - कंकाळी तिवळा



Toy Cart Bronze Kolhapur

Appendix

AGRICULTURE Statistical Data for 1992-93

APPENDIX

(1) KEY STATISTICS OF THE INDIAN ECONOMY

N. B. Figures for 1991-92 are not final in all cases.

Agriculture	Agricultural Production Index	Agricultural Productivity Index	Foodgrains Production
	1967-70 = 100		Mn. tonnes
1950-51	58.5	76.0	50.8
1960-61	86.7	94.2	82.0
1970-71	111.5	108.8	108.4
1980-81	135.3	127.8	129.6
1985-86	158.4	149.0	150.4
1990-91	191.8	176.7	176.2
1991-92	[190.0	n.a.	172.0]

(2) NET DOMESTIC PRODUCT BY INDUSTRY OF ORIGIN*

(At Current Prices)

	1990-91†	1989-90†	1988-89	1981-82
	Rs. crores			
Primary	1,50,586	1,25,708	1,13,994	52,755
Of Which	(35.8)	(35.3)	(36.5)	(41.0)
Agriculture	1,32,927	1,09,150	98,927	44,971
	(31.6)	(30.7)	(31.6)	34.9)

Note: Figures in brackets show percentages to total.

† Provisional

(3) NET DOMESTIC PRODUCT BY INDUSTRY OF ORIGIN

(At 1980-81 prices)

	1990-91†	1989-90†	1988-89	1981-82
	Rs. crores			
Primary	65,245	62,663	60,718	48,416
Of Which	(34.6)	(35.1)	(36.1)	(41.3)
Agriculture	58,921	56,401	54,477	42,643
	(31.3)	(31.6)	(32.4)	(36.4)

Note: Figures in brackets show percentages to total.

† Provisional.

(4) STATES' DOMESTIC PRODUCTS & PER CAPITA INCOMES
(At Current Prices)

	Net domestic product		Per capita income	
	1989-90*	1980-81	1989-90*	1980-81
	Rs. crores		Rs	
Andhra Pradesh	19,793†	7,324	3,211†	1,380
Arunachal Pradesh	342	97	4,176	1,561
Assam	7,699	2,356	3,179	1,200
Bihar	17,824	6,077	2,122	878
Goa	851	315	6,939	3,145
Gujarat	21,668	6,594	5,404	1,951
Haryana	10,032	3,032	6,265	2,370
Himachal Pradesh	1,999	721	4,005	1,698
Jammu & Kashmir	2,422†	974	3,420†	1,649
Karnataka	18,012	5,866	4,075	1,596
Kerala	9,991	3,782	3,389	1,494
Madhya Pradesh	18,00	6,122	2,878	1,183
Maharashtra	45,613	15,113	6,184	2,427
Manipur	618	201	3,502	1,430
Meghalaya	551	180	3,250	1,361
Orissa	9,416	3,225	3,066	1,231
Punjab	14,311	4,451	7,081	2,675
Rajasthan	12,253†	4,126	2,923†	1,222
Tamil Nadu	21,562	7,218	3,894	1,498
Uttar Pradesh	40,719	14,102	3,072	1,286
West Bengal	25,944	8,637	3,963	1,564

Note: Owing to differences in source material used the figures for different States are not strictly comparable.

* Provisional.

† 1988-89

(5) GROSS VALUE OF OUTPUT FROM AGRICULTURE

	At current prices		At 1980-81 prices	
	1988-89*	1981-82	1988-89*	1981-82
	Rs. crores		Rs. crores	
Cereals	41,894	21,323	24,812	19,255
Of which				
Paddy	23,681	11,006	12,808	9,651
Wheat	11,685	5,899	7,770	5,416
Jowar	2,446	1,781	1,485	1,762
Bajra	1,327	808	1,032	723
Pulses	7,859	3,156	4,089	3,418
Of which				
Gram	3,059	1,180	1,578	1,408
Oilseeds	12,061	5,142	7,587	5,034
Of which				
Groundnut	5,101	2,523	3,272	2,247
Rapeseed & mustard	2,469	1,061	1,891	1,181
Sugarcane	6,292	3,764	5,043	4,710
Kapas	3,295	1,923	2,090	1,910
Jute	393	214	197	200
Tea	758	427	507	413
Coffee	498	175	235	167
Tabacco	582	450	345	457
Condiments & spices	3,596	1,236	1,478	1,076
Fruits & vegetables	11,912	5,714	6,232	5,269
Rubber	344	158	244	142
Others	12,544	7,198	6,911	6,821
Total	1,02,028	50,880	59,770	48,872

* Provisional.

(6) VALUE ADDED FROM AGRICULTURE AND ALLIED ACTIVITIES

	At current prices		At 1980-81 prices	
	1988-89*	1981-82	1988-89*	1981-82
	Rs. crores		Rs. crores	
Gross value of output	1,33,541	63,688	75,688	60,163
Of which				
Agriculture	1,02,028	50,880	59,770	48,872
Livestock	31,513	12,808	15,918	11,291
Less inputs	31,658	16,892	19,647	15,885
Seed	3,149	1,844	1,947	1,776
Organic manures	1,657	753	726	685
Chemical fertilisers	5,752	3,010	4,777	2,633
urrent repairst	2,224	871	1,001	792
Feed of livestock	14,929	8,335	8,301	8,166
Irrigation charges	244	147	170	135
Market charges	1,322	660	777	634
Electricity	618	314	732	279
Pesticides and insecticides	621	300	394	280
Diesel oil	1,142	658	822	505
Gross value added				
Agriculture & allied	1,01,883	46,796	56,041	44,278
Operation of irrigation system	2,965	940	1,329	867
Total	1,04,848	47,736	57,370	45,145
Less Depreciation	5,921	2,765	2,893	2,502
Net value added	98,927	44,971	54,477	42,643

* Provisional

† Including maintenance of fixed assets & other operational costs.

**(7) INDEX NUMBERS OF AGRICULTURAL PRODUCTION
AND PRODUCTIVITY**

	1990-91*	1989-90	1988-89	1980-81	1970-71
	Triennium ending 1969-70 = 100				
Production					
All commodities	191.8†	187.0	183.2	135.3	111.5
Foodgrains	189.4	183.4	182.5	137.5	112.9
Non-foodgrains	196.9	194.5	184.8	130.5	108.6
Selected crops					
Rice	191.3	188.7	180.8	137.2	107.4
Wheat	302.0	276.1	299.7	201.2	132.1
Gram	99.8	81.0	98.5	83.2	99.7
Groundnut	147.8	157.1	187.3	97.0	118.4
Cotton	174.2	203.9	156.1	125.1	85.1
Jute	157.0	142.5	135.2	131.2	99.6
Sugarcane	201.5	189.2	170.3	129.4	106.4
Tea	181.5	181.5	178.0	144.7	106.4
Coffee	331.3	331.3*	331.3	182.9	170.1
Tobacco	156.8	154.9	138.4	135.1	101.8
Productivity					
All commodities	176.7	174.0	170.1	127.8	108.8
Foodgrains	180.7	176.1	174.0	132.2	110.7
Non-foodgrains	162.9	164.4	158.4	116.8	104.3
Selected crops					
Rice	166.0	165.4	160.1	126.3	105.6
Wheat	200.0	186.6	197.4	143.4	115.0
Gram	103.5	96.2	111.3	97.2	98.0
Groundnut	129.3	130.9	159.3	103.5	117.2
Cotton	183.4	206.3	165.6	124.5	87.0
Jute	145.9	152.0	141.3	101.1	96.4
Sugarcane	132.1	132.8	123.4	117.0	99.3
Tea	150.4	150.4	149.5	131.8	104.5
Coffee	176.5	176.5†	176.5	112.3	162.0
Tobacco	165.8	162.7	159.3	129.9	98.8

* Provisional

† 1991-92 (190-0)

(8) AGRICULTURAL PRODUCTION

	1990-91 (Prov.)	1989-90	1988-89	1980-81	1970-71
	Mn. tonnes				
Foodgrains	176.2*	171.0	169.9	129.6	108.4
Cereals	162.2	158.2	156.1	119.0	96.6
Rice	74.6	73.6	70.5	53.6	42.2
Wheat	54.5	49.8	54/1	36.3	23.8
Jowar	11.9	12.9	10.2	10.4	8.1
Bajra	6.9	6.6	7.8	5.3	8.0
Maize	9.1	9.7	8.2	7.0	7.5
Others	5.2	5.6	5.3	6.4	7.0
Pulses	14.0	12.6	13.8	10.6	11.8
Gram	5.2	4.2	5.1	4.3	5.2
Tur	2.4	2.7	2.7	2.0	1.9
Others	6.4	5.7	6.0	4.3	4.7
Oilseed†	18.4	16.9	18.0	9.4	9.6
Groundnut (in shell)	7.6	8.1	9.7	5.0	6.1
Rapeseed & Mustard	5.2	4.1	4.4	2.3	2.0
Others	5.6	4.7	3.9	2.1	1.5
Tobacco	0.45	0.56	0.49	0.48	0.36
Cotton (lint)‡	9.8	11.4	8.7	7.0	4.8
Jute‡	7.8	7.1	6.7	6.5	4.9
Sugarcane (cane-weight)	240.3	225.6	203.0	154.2	126.4
Tea@	0.71	0.68	0.70	0.57	0.42
Coffee	0.17	0.12	0.22	0.12	0.11

* 1991-92 (172 mn. tonnes).

† Comprising groundnut, rapeseed & mustard, sesamum, linseed, castorseed, nigerseed, safflower, sunflower and soyabean.

‡ Cotton in mn. bales of 170 kg. & jute in mn. bales of 180 kg. each.

@ Calendar years.

(9) AREA UNDER AGRICULTURAL CROPS

	1990-91*	1989-90	1988-89	1980-81	1970-71
	Mn. hectares				
Foodgrains	127.5	126.8	127.7	126.7	124.3
Cereals	103.1	103.3	104.5	104.2	101.8
Rice	42.6	42.2	41.7	40.1	37.6
Wheat	24.0	23.5	24.1	22.3	18.2
Jowar	14.5	14.8	14.6	15.8	17.4
Bajra	10.4	10.9	12.0	11.7	12.9
Maize	5.9	5.9	5.9	6.0	5.8
Others	5.7	6.0	6.2	8.3	9.9
Pulses	24.4	23.4	23.1	22.5	22.6
Gram	7.4	6.5	6.8	6.6	7.8
Tur	3.6	3.6	3.5	2.8	2.7
Others	13.4	13.3	12.8	13.1	12.1
Oilseed†	24.0	22.8	21.9	17.6	16.6
Groundnut	8.5	8.7	8.5	6.8	7.3
Rapeseed & Mustard	5.7	5.0	4.8	4.1	3.3
Others	9.8	9.1	8.6	6.7	6.0
Tobacco	n.a.	0.42	0.38	0.45	0.45
Cotton	7.4	7.7	7.3	7.8	7.6
Jute	n.a.	0.68	0.69	0.94	0.75
Sugarcane	3.7	3.4	3.3	2.7	2.6
Tea	n.a.	0.41	0.41	0.38	0.36
Coffee	n.a.	n.a.	0.24	0.21	0.14

* Provisional

† See second footnote to Table 42

(10) SHARE OF STATES IN AGRICULTURAL PRODUCTION

	Rice	Wheat	Pulse	Total food-grains	Ground-nut	Sugar-cane
	% of national production					
Andhra Pradesh	13.8	—	5.3	7.4	26.1	5.1
Assam	3.9	0.2	0.4	1.8	—	0.9
Bihar	8.7	6.7	6.4	6.9	0.1	2.7
Gujarat	1.0	2.0	3.2	2.4	20.0	3.7
Haryana	2.1	11.4	3.2	5.1	—	3.0
Himachal Pradesh	0.1	1.0	0.1	0.7	—	—
Jammu & Kashmir	0.8	0.5	0.2	0.7	—	—
Karnataka	3.4	0.3	4.5	4.2	12.2	8.7
Kerala	1.5	—	0.2	0.7	0.1	0.3
Madhya Pradesh	6.8	8.8	21.0	9.4	3.7	0.8
Maharashtra	3.3	1.7	13.0	7.4	11.1	13.6
Orissa	7.5	0.1	8.3	4.1	6.2	2.9
Punjab	8.5	22.9	0.9	11.0	0.2	1.5
Rajasthan	0.2	6.9	8.7	5.0	2.6	0.4
Tamil Nadu	8.7	—	3.0	4.8	15.9	10.9
Uttar Pradesh	12.5	36.1	19.9	20.3	1.4	44.8
West Bengal	15.3	1.3	1.6	7.0	0.3	0.5
Others	1.9	0.1	0.1	1.1	0.1	0.2
All India	100.0	100.0	100.0	100.0	100.0	100.0

Note: Based on average production during the period 1987-88 to 1989-90.

(11) YIELD OF SELECTED CROPS

	1990-91*	1989-90	1988-89	1980-81	1970-71
	Kg. per hectare				
Foodgrains	1,382	1,349	1,331	1,023	872
Kharif	1,238	1,241	1,166	933	837
Rabi	1,631	1,544	1,628	1,195	942
Cereals	1,573	1,530	1,493	1,142	954
Kharif	1,364	1,366	1,270	1,015	892
Rabi	2,001	1,875	1,964	1,434	1,093
Pulses	576	549	598	473	524
Kharif	474	480	504	361	410
Rabi	667	616	686	571	607
Rice	1,751	1,745	1,689	1,336	1,123
Kharif	1,681	1,677	1,627	1,303	1,100
Rabi	2,685	2,678	2,548	2,071	1,625
Wheat	2,274	2,121	2,244	1,630	1,307
Jowar	819	869	697	660	466
Kharif	973	1,053	789	737	533
Rabi	594	604	550	520	354
Maize	1,524	1,632	1,395	1,159	1,279
Bajra	661	610	646	458	622
Gram	701	652	753	657	663
Oilseedst	769	742	824	532	579
Kharif	703	691	805	492	649
Rabi	859	822	851	588	449
Groundnut	919	930	1,132	736	834
Sugarcane (tonnes) ©	65	65	61	58	48
Cotton	224	252	202	152	106
Jute	1,803	1,879	1,748	1,245	1,186

* Provisional.

© In terms of cane-weight

(12) PLAN OUTLAYS

N. B. See Notes on page 182

	8th Plan	7th Plan*	6th Plan*	5th Plan
	Targets	Actuals		
Amount (Rs.crores)				
Agriculture etc.	62,870	28,039	13,620	4,865
Irrigation	26,548	16,590	10,930	3,877
Percentages				
Agriculture etc.	14.5	12.7	12.3	12.3
Irrigation	6.1	7.5	9.9	9.8
	4th	3	3rd	2nd
	Plan	Annual Plans	Plan	Plan
	Actuals			
Amount (Rs.crores)				
Agriculture etc.	2,320	1,107	1,089	549
Irrigation	1,354	471	664	430
Percentages				
Agriculture etc.	14.7	16.7	12.7	11.7
Irrigation	8.6	7.1	7.8	9.2

* Minor irrigation is included under 'Irrigation' and not under 'Agriculture etc.', as in case of other Plans.

(13) CENTRE & STATE OUTLAYS IN EIGHTH PLAN

	(Rs. crores)		
	Centre	States*	Total
Agriculture etc. †	35,581	27,289	62,870
Irrigation	1,207	25,341	26,546

* Including Union Territories

† Including Rural Development & Minor Irrigation

(14) ANNUAL PLAN OUTLAYS

(Rs. crores)

	1991-92	1990-91	1989-90	1988-89
Agriculture etc.*	8,915	7,517	7,329	5,885
Irrigation	4,699	3,837	3,638	3,591

	1987-88	1986-87	1985-86	1984-85
Agriculture etc.*	5,889	4,884	4,052	3,887
Irrigation	3,347	3,222	2,792	2,654

Note: Actual figures up to 1989-90; revised estimates for 1990-91 and 1991-92. For 1992-93, the target is Rs. 80,741 crores.

* Excluding minor irrigation which is included under irrigation.

(15) PRIVATE SECTOR INVESTMENT

	8th plan	7th plan	6th plan	4th plan	3rd plan
Amount (Rs. crores)					
Agriculture & allied*	96,800	34,048	16,101	1,600	800
Percentages					
Agriculture & allied*	22.2	20.2	21.6	17.8	19.5

Note: Figures shown are targets. The Fifth Plan did not give a break-up of total investment target of Rs. 27,048 crores.

* Including irrigation.

(16) PHYSICAL TARGETS AND ACHIEVEMENTS

Agriculture		Production			
		Foodgrains	Oilseeds*	Cotton	Jute†
		Mn. tonnes		Mn. bales	
4th Plan	Targets	129.0	10.5	8.0	7.4
	Actuals	104.7	8.9	6.3	6.2
5th Plan	Targets	125.0	12.0	8.0	7.7
	Actuals	131.9	9.4	8.3	7.7
6th Plan	Targets	149/154	11.0	9.2	9.1
	Actuals	145.5	10.9	8.5	7.8
7th Plan	Targets	178/183	18.0	9.5	9.5
	Actuals	171.0	16.9	11.4	8.3
8th Plan	Targets	210.0	23.0	14.0	9.5

Agriculture		Irrigation Potential Utilisation (Mn. hectares)	Fertiliser consumption (Mn.) tonnes of nutrients)		
			Nitrogenous	Phosphatic	Potassic
4th	Targets	43.0	3.20	1.40	0.90
	Actuals	42.2	1.83	0.65	0.36
5th Plan	Targets	53.3	3.40	0.87	0.53
	Actuals	50.7	3.42	1.11	0.59
6th Plan	Targets	66.2	6.00	2.34	1.31
	Actuals	60.6	5.49	1.88	0.84
7th Plan	Targets	70.6	9.1/9.3	3/3.2	1.4/1.5
	Actuals	70.9	7.39	3.01	1.17
8th Plan	Targets	89.3	11.50	5.00	1.80

* Upto 6th Plan relate to five major oilseeds; and thereafter to four more.

† Including mesta from 5th Plan onwards

(17) INDIA'S RANKING IN THE WORLD

		World total	India	India's rank in the world
Agriculture				
Arable land	(Mn. 1,477 hectares)		169	3
Irrigated area	(Mn. 233 hectares)		43	2
Tractors in use	(Mn.)	26.2	0.93	9
Nitro. fertiliser consumption	(Mn. tonnes)	79.1	7.4	4
Cattle population	(Mn.)	1,279	197	1
Production				
Rice (paddy)	(Mn. tonnes)	519	113	2
Wheat	(Mn. tonnes)	595	50	4
Groundnut (in Shell)	(Mn. tonnes)	23.1	7.2	1
Cotton (lint)	(Mn. tonnes)	18.5	1.8	4
Tobacco	(Mn. tonnes)	6.6	0.5	3
Tea	(Mn. tonnes)	2.5	0.7	1
Potatoes	(Mn. tonnes)	270	15	5

(18) INDEX NUMBERS OF AGRICULTURAL PRODUCTION

	Average				Annual growth rate 1980-90*
	1990	1989	1985	1980	
	1979-81=100				%
World	124	122	114	99	2.3
of which					
India	145	146	123	98	4.0
Australia	121	115	110	93	2.7
Bangladesh	128	126	113	101	2.4
Brazil	126	136	120	100	2.3
Burma	116	115	138	99	1.6
Canada	125	114	113	99	2.4
China	158	149	132	99	4.8
Egypt	146	141	125	99	3.9
France	103	103	107	101	0.2
Germany(W)	113	113	108	101	1.1
Iran	135	131	131	97	3.4
Israel	107	107	124	98	0.8
Italy	96	103	101	102	-0.6
Japan	98	99	107	96	0.2
Kenya	150	145	123	100	4.2
Korea, Rep	98	110	112	89	1.0
Mexico	120	114	113	100	1.8
Pakistan	154	150	124	99	4.5
Philippines	113	109	100	100	1.2
Sri Lanka	102	96	109	101	0.2
U. K.	111	110	110	103	0.8
U. S. A.	105	102	107	95	0.9
U. S. S. R.	119	120	111	100	1.8

* Compound rate.

(19) OUTPUT AND YIELD OF SELECTED AGRICULTURAL CROPS, 1990

N.B: Figures under the Output columns show the percentage share of major producing countries in the total world production of Rice, (Paddy 519 mn. tonnes), Wheat (595 mn. tonnes), Cotton (18 mn. tonnes) and Groundnut (23 mn. tonnes) respectively. Yield figures are expressed in 100 kg. per hectare.

	Rice (Paddy)		Wheat	
	Output	Yield	Output	Yield
India	21.7	26.9	India	8.3 21.2
Bangladesh	5.4	26.6	Australia	2.6 16.0
Brazil	1.4	18.8	Canada	5.3 22.6
Burma	2.7	29.1	China	16.1 31.8
China	36.3	57.3	France	5.6 64.9
Indonesia	8.6	43.2	Pakistan	2.4 18.3
Japan	2.5	63.3	Turkey	3.4 21.2
Philippines	1.8	28.1	U.K.	2.3 69.1
Thailand	3.7	19.6	U.S.A.	12.5 26.6
Vietnam	3.5	31.2	U.S.S.R.	18.1 22.4
	Cotton (Lint)		Groundnut (in shell)	
	Output	Yield	Output	Yield
India	9.8	2.3	India	31.2 9.0
Argentina	1.4	4.6	Argentina	1.6 20.6
Australia	1.7	13.3	Burma	2.0 8.8
Brazil	3.6	3.5	China	28.4 21.3
China	24.2	8.0	Indonesia	4.0 14.6
Egypt	1.8	7.7	Nigeria	5.0 11.7
Pakistan	8.0	5.5	Senegal	3.0 7.9
Turkey	3.3	9.1	U.S.A.	7.1 22.4
U.S.A.	18.4	7.2	Zaire	1.9 7.5
U.S.S.R.	14.2	8.3	Vietnam	0.9 9.6

APPENDIX
(20) KEY CENSUS STATISTICS

		1991	1981	1971
Population	(Mn.)	844	683	548
Density	(per km ²)	267	216	177
Persons per household	(No.)	n.a.	5.55*	5.46
Districts	(No.)	429	412	360
UAs/towns	(No.)	3,768	3,378	2,590
Villages (inhabited)	('000s)	n.a.	557*	576
Rural population	(Mn.)	627	524	439
Urban population	(Mn.)	217	159	109
Urban as % of total	(%)	25.7	23.3	19.9
Male population	(Mn.)	438	353	284
Female population	(Mn.)	406	330	264
Female per 1,000 males	(No.)	929	934	930
Workers *	(Mn.)	307	242	181
Male	(Mn.)	218	179	145
Female	(Mn.)	89	63	36
Birth rate	(per 1,000)	32.5	37.2	41.2
Death rate	(per 1,000)	11.4	15.0	19.0
Expectation of life at birth	(years)	58.2	50.5	45.6
Male	(years)	57.7	50.9	46.4
Female	(years)	58.7	50.0	44.7
Literacy rate	(%)	52.1†	43.6*	34.5
Male	(%)	63.9†	56.4*	46.0
Female	(%)	39.4†	29.8*	22.0

Note: Birth rate and death rate under 1991, 1981 & 1971 relate to 1981-90, 1971-80 and 1961-70 respectively; expectation of life at birth to 1991-92, 1971-80 and 1961-70. Workers are total of main and marginal.

* Excluding Assam.

† Excluding J & K.

(21) HIGHLIGHTS OF 1991 CENSUS

	Decennial growth of population		Females per 1,000 males	
	[%]		1991	1981
	1981-91	1971-81		
Andhra Pradesh	23.9	23.1	973	975
Assam	23.6	23.4†	925	910†
Bihar	23.5	24.1	912	946
Goa	16.0	26.7	969	975
Gujarat	20.8	27.7	936	942
Haryana	26.3	28.8	874	870
Himachal Pradesh	19.4	23.7	996	973
Jammu & Kashmir*	28.9	29.7	923*	892
Karnataka	20.7	26.8	961	963
Kerala	14.1	19.2	1,040	1,032
Madhya Pradesh	26.8	25.3	932	941
Maharashtra	25.4	24.5	935	937
Manipur	28.6	32.5	961	971
Meghalaya	31.8	32.0	947	954
Nagaland	56.9	50.1	890	863
Orissa	19.5	20.2	972	981
Punjab	20.3	23.9	888	879
Rajasthan	28.1	33.0	913	919
Tamil Nadu	14.9	17.5	972	977
Tripura	33.7	31.9	946	946
Uttar Pradesh	25.4	25.5	881	885
West Bengal	24.6	23.2	917	911
Delhi	50.6	53.0	830	808
All India (Incl. Others)	23.6	24.7	929	934

* Official
projection, and not
census estimate.

† Revised estimate.

(22) SELECTED AGRICULTURAL STATISTICS

	Economically active population in agriculture as % of total	Arable land* (Ma. hectares)	Per capita arable land* (hectares)	Fertiliser consumption per hectare of arable land (kg.)†
India	67	169.0	0.20	68.7
Australia	5	48.9	2.91	22.6
Bangladesh	69	9.3	0.08	99.3
Brazil	24	78.7	0.53	43.0
Canada	3	46.0	1.75	47.2
China	68	96.1	0.09	261.9
Egypt	41	2.6	0.05	404.3
France	5	19.1	0.34	319.2
Germany†	5	12.4	0.16	370.5
Iran	28	14.8	0.28	79.7
Israel	4	0.4	0.10	242.5
Italy	7	12.0	0.21	150.7
Japan	6	4.6	0.04	417.9
Korea. Rep	25	2.1	0.05	425.0
Mexico	30	24.7	0.28	72.8
Pakistan	50	20.7	0.17	89.0
Philippines	47	8.0	0.13	67.4
Sri Lanka	52	1.9	0.11	101.5
U. K.	2	6.7	0.12	350.2
U. S. A.	2	189.9	0.77	98.5
U. S. S. R.	13	230.6	0.80	160.4
Yugoslavia	22	7.8	0.33	115.5

Note: Data relate to 1989 or 1990.

* Including area under permanent crops.

† Relate to united Germany.

Source: *Statistical Outline of India, 1992-93, Tata Services Ltd., Bombay. Pub. by Tata Services Ltd., Dept. of Economics & Statistics, 20th edition, October 1992.*

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