

BEST PRACTICES OF AGRICULTURE IN INDIA

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ABSTRACT

This paper deals with best agricultural practices in India. 70 % Indian people is engaged in agriculture. The Subsistence and plantation agriculture practices are two major farming systems in most part of India. Variety of crop cultivated in India such as food crops, commercial crops, horticultural crops. The major crops grown are Rice (*Oryza sativa* Linn.), Wheat (*Triticum aestivum* L.), bamboo (*Bambusa vulgaris*), tea (*Camellia sinensis*), coconut (*Cocos nucifera*), arecanut (*Areca catechu*), soybean (*Glycine max*) etc. India cultivates annually 1-3 crops on its 125 million hectares of agricultural land, exclusively depending upon the availability of water for irrigation. Due to unawareness of the cost: benefit ratio in using modern irrigation practices, out of available water, almost 60% used in irrigation is wasted. India has different climatic condition along with different topography and hilly terrain, it is main reason to the farmers predominantly use drip irrigation practice. For soil fertility different sates has different techniques used.

Keywords: Best Agriculture practice, Mixed crop, crop rotation, Cost benefits ratio, climatic condition

INTRODUCTION

Agriculture and food production are the base of life and economy and it plays a very vital role in build up and the sustainability of vigorous societies (Tripathi et al., 2015). It provides food and fiber. Farming agriculture, food, and fiber is an essential part of economy, providing jobs along with essential commodities (IFOAM, 2013). India is agricultural based country and about 70% of Indian rural population depends on agriculture, 52% in total number of jobs. (Arjun, 2013) and 16.1 % in Indian GDP during FY 2014-15 (IBEF, 2015) and about 43% of India's geographical areas are using in agriculture activity (Hari K, 2014). The contribution in agriculture of some dominant states of India are Punjab, Uttar Pradesh, Madhya Pradesh, Haryana, Bihar, Andhra Pradesh, Maharashtra, West Bengal ,Gujarat, these all states economy and development depended on the agriculture directly or indirectly. The contribution of

agriculture sector in Indian GDP decreases over the past four decades (Arjun, 2013). This has happened due to neglect of people towards agriculture due to the unwillingness to put in hard efforts in this field. Indian farmer cultivated different variety of crops due to highly expanded topography, altitude and climatic conditions. Rice (*Oryza sativa* Linn.) and wheat (Biological name), and Maize (*Zea mays* Linn.) are the major food crops. Non food products are Oil seeds (Groundnut, Rapeseed, soyabean, etc.) and important fruits grown are mango (*magnefira indica*) Orange (*Citrus reticulate* Blanco), Pineapple (*Ananas cosmosus* Merrill) Lemon (*Citrus limon* Burm. F.), guava (*Psidium guajava* Linn.), jack fruit (*Artocarpus heterophyllus* Lam.) and bananas (*Musa* sp.). Potato (*Solanum tuberosum* Linn.), jute (*Hibiscuc cannabinus* Linn.), Cotton (*Gossypium* Sp.) and black pepper (*Piper nigrum* Linn.) are the chief commercial crops (<http://www.nios.ac.in>).

These change in the values connected with agriculture in many developed countries have given rise in the past twenty years to a wide array of social, environmental and quality standards, codes of practices and certification programmes in agriculture and the food sector (Poisot et al., 2004). Governments, especially in developed countries, have established regulations on food safety and quality, voluntary standards on organic agriculture, and sustainability assessments schemes. A multiplicity of ‘Best agriculture Practices (BAP)’ codes, standards and regulations have also appeared from governments, NGOs and CSOs as well as producers organizations and the food industry, claiming to codify sustainable agriculture at farm level. There are four pillar of BAP, Economic viability, environmental sustainability, social acceptability and food safety and quality.

The words “Best Agricultural Practices” (BAP) is clearly used in some of these policies, though not all. Still in all these standards, the fundamental hypothesis is that the standard codifies some form of best practice (Poisot et al., 2004). However “Best agricultural practices’ is used to refer to extensively unstable elements, from examining of pesticides utilize, to more surrounding features of primary production and post production systems, such as environmental impact assessment or labour conditions. The model of best agricultural practices has developed outside, and enlarged on, such manufacture recommendation. Consumers and hence the food industry and the development community are every day more concerned that food more and more of which comes through processing and supermarket chains is safe to eat. They also increasingly care that commodities are produced in ways that are in harmony with the environment and social values (e.g., at least the minimal needs of farm workers are met; international agreements on child labour are respected, etc.). This study aims to show the best practices of agriculture in India.

BEST PRACTICES OF AGRICULTURE

India got lowest rank for many yield producing crops. This is partly due to structural limitation such as patchy land and the stumpy use of farm technology and paramount farming techniques. On the basis of nature of land, climatic characteristic and available irrigation facilities Indian farmers practices different type of farming systems.

Plantation agriculture practices:

This type of agriculture first time introduced in India in the 19th century by British ruler. The term plantation agriculture refers to those crops which are cultivated on a broad scale in adjacent area, owned managed by an individual or a company. Some of the exceptional features of plantation agriculture are huge assets input, enormous assets, managerial ability, technical expertise, complicated farm machinery, fertilizers, and good transport facilities (Mondal, 2015). It plays an important role in solving the problem of food protecting and food security. Such type of agriculture is generally practices in Assam, sub-Himalayan west Bengal, and Nilgiri, Anaimalai, and Cardamom Hill in the south. Planting tree are tea, coffee, cocoa, banana, spices, coconut, arecanut, oil palm, cashew and rubber etc.

The farming of vanilla had been started in India since 1990s and was mostly observed in the Karnataka and Kerala and to a smaller area of Tamil Nadu, Northeast region, Lakshadweep and the Andaman and Nicobar Islands. India's produced of vanilla about 101 Metric Tones from about 27,811 hectare in 2004-05. Coconut is grown in an area of 1.93 million ha. with a production of 12,148 million nuts and productivity of 6285 nuts per ha. India is also one of the largest producer and consumer of cashew nuts. The total production of cashew is approx 0.57 million tones from and area of 0.24 million hectares (NPCMT, 2011). The leading Plantation of agriculture states are shown in Fig. (1)

The financial significance of these Crops

1. India got number one position in the total production of definite plantation agriculture in the world. As for example, our production meets the share of 47% in tea and 66 % in each of cashew and arecanut.
2. They contribute to national economy by way of export earnings. These crops occupy less than 2 % of the total cultivated area (i.e. 3.82 per cent of total crop land) but they generate an income of around Rs. 16,000 million or about 12.72 per cent of the total export earnings of all commodities or 75 per cent of total earnings from the export of agricultural produces.
3. Plantation industry provides direct as well as indirect employment lo many millions of people. For instance, tea industry offers direct employment to 10 lakhs and indirect employment to 10

lakh people, while-cashew processing factories alone provide employment to 3 lakhs people besides 2 lakhs farmers are employed in cashew cultivation.

4. These crops help to conserve the soil and ecosystem. Tea planted in hill slopes and cashew in barrel and waste lands protect the land from soil erosion during the rainy season or due to heavy winds.

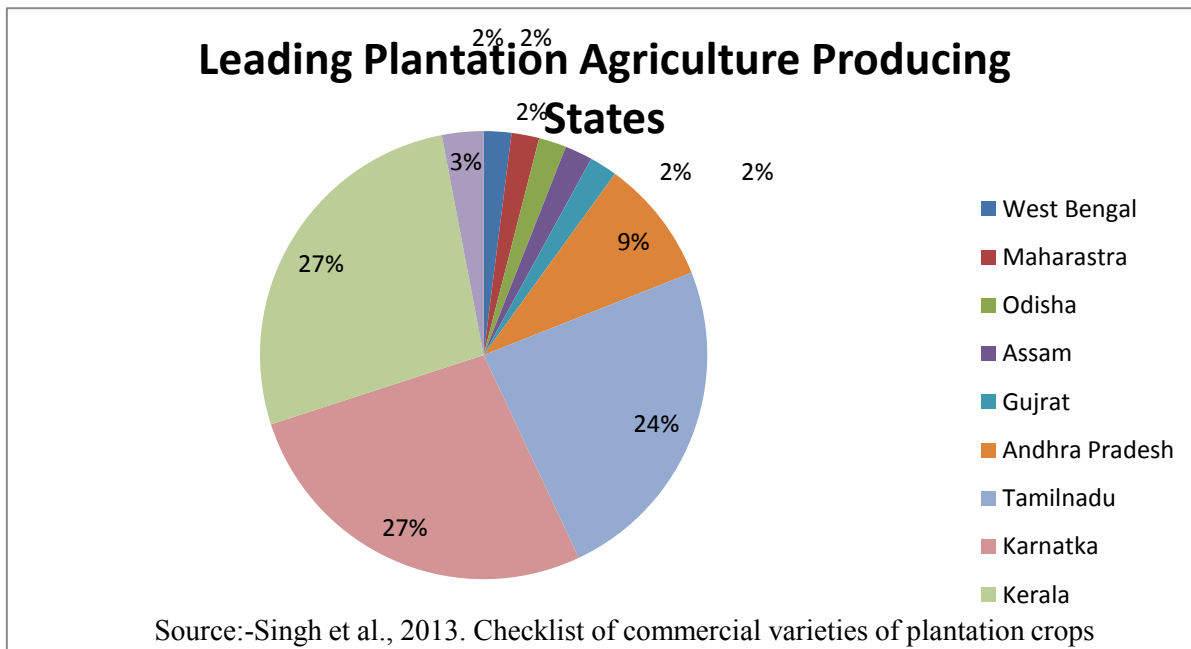


Figure: 1. Leading plantation Agriculture Producing states.

SUBSISTENCE AGRICULTURE PRACTICE:

Subsistence agriculture means farming from own consumption. It is practiced in all most all part of country. This type of agriculture has been practiced in India for several hundreds of years and still succeeds in a bigger part of India instead of more changes in agricultural practices after independence. In these techniques the crop is cropping and it is involve only rearing enough animals and growing enough crops to supports food grains for people. In India this techniques is participated due to low economy of farmer. It can be considered as a ‘survival strategy’ for coping with the risks and uncertainties that threaten the welfare of poor rural families as well as their urban relatives during periods of drastic economic reforms and economic collapse. This applies not only in low income developing countries, but also in middle income countries (Redman, 2010). This type of farming totally depends on the natural condition like monsoon,

fertility of the soil and other environmental conditions to the crop grown. In this farming system mainly cultivate cereals along with oil seeds, pulses, vegetables and sugarcane.

CROP ROTATION AND MIXED CROP PRACTICES

Crop rotation practices refer to mounting a variety of crops continuous in a fixed rotation to preserve the fertility of the soil. Through Crop rotations practices legumes helps to built-up population of pest species, life cycle disorder, nitrogen fixation, control of off-site pollution and increasing the biodiversity at very low cost (Kassam and Friedrich, 2009; Dumanski et. al., 2006). It is a traditional farming systems in the semi-arid tropics and Its important characteristic of all organic cropping systems because it make a stage for build up fertility of soils, manage pests, (Mohler and Johson, 2009); high yields, prevention of diseases, weed control (Mishra et al., 2009).crop rotation practices benefits shown in (Fig.2)

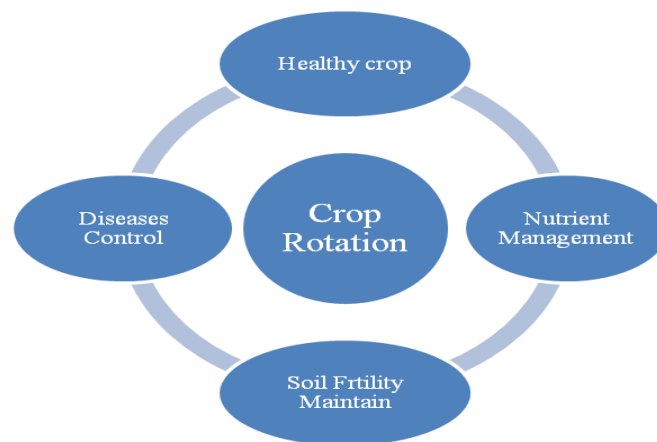


Figure: 2. Crop rotation improve the soil health

Mixed crop practices are a traditional agricultural practice and it is defined as when the two or more crops farming together on the same field in same time (Papendick et al., 1976 and Willey, 1979). It is mostly practice in subsistence farming all over the tropics for diverse reasons similar to enhanced production with limit agricultural land, reduced threat of crop failure through spread out harvest, wages of labour, increased foods variety and enhanced use of resources (Mishra et al., 2009). The production and food supply of mixed crop is more than single crop (Mishra et al., 2009). The mixed crop also improves the soil fertility, conservation of water and soil and increased the microclimatic conditions (Ranganathan, 1993; Sharma et al., 1998). Aiyer (1949) shown his studied 80-90 % pigeonpea (*Cajanus cajan*; hillgram;tur) is mixed crop in India.

SHIFTING AGRICULTURE PRACTICES

Shifting agriculture is the most common form of agriculture practice of the Indian farmers and is commonly called Jhum or Swidden cultivation in Meghalya, India. It is also known by slash and burn agriculture. This is the one of the most ancient systems of farming supposed to have initiated in the Neolithic period around 700 B C. (Borthakur, 1982). Such types of cultivation technique primarily practices by the ethnic people. Ethnic people are burning the trees and where crops are grown. During two to three years when fertility loosed then they left this land and go to shift the other piece of land. This process continues and the farmers again shift to the first piece of land after a gap of 10-15 years, when this land becomes fertile. This type of agriculture is practiced over an area of 54 laks hectares, 20 lakh hectares being cleared every year (Mondal, 2015). Dry paddy, buck wheat, maize, small millets, tobacco and sugarcane ate the main crops grown under this type of agriculture. The shifting cultivation practices north east of India due to hilly areas and tropical regions (Jeeva et al 2006). In the North –East as a whole nearly 4.44 lakh families are engaged in shifting cultivation (GOI, 2000). The shifting agriculture in North- East is shown in (Table 1). The shifting agriculture maximum practices in Manipur and Nagaland land use are 53.8% and 31.5% respectively (Yadav and Kaneria, 2012).

Table: 1. Area under shifting agriculture in different North-Eastern states.

States	Area under shifting cultivation (Lakh ha)	Share of net sown area (per cent)	Percentage of forest area under shifting cultivation
Arunachal Pradesh	70.0	4.7	12.4
Assam	69.6	2.6	27.9
Maniput	90.0	64.2	77.4
Meghalaya	53.0	27.0	43.4
Mizoram	63.0	46.0	68.5
Nagaland	19.0	34.5	74.1
Tripura	22.0	8.2	62.3
Total	386.9	26.7	52.3

Source: Mishra(2000), Mishra and Sharma (2001).

This type of agriculture knows by different name in different parts of India. The subsistence agriculture known by the name of Bewar in Madhya Pradesh, Padu in Andhra Pradesh, Koman in Orissa, Valre in Rajshtan. Jhumming in North- eastern region.

AGRICULTURE CROPPING PRACTICES

India produces a variety of agriculture crops such as food crops, commercial crops, horticultural crops, etc. (Singh, 2002 ; Singh and Saxena, 2002). Of the total agricultural land in India 61.4% and the rice (*Oryza sativa* Linn.), India share in global rice production has about in the range of 19.50 to 24.52%. (<http://agricoop.nic.in>). Maximum rice producing state of India is Andhra Pradesh. India produces three cropping seasons for rice, autumn rice (7%), winter rice (84%), and spring rice (9%) (<http://drd.dacnet.nic.in>). Top rice producer states are West Bengal, Punjab and Uttar Pradesh. Other rice growing states are Tamilnadu, Andhra Pradesh, Bihar, Jharkhand, Uttarakhand, Chhattisgarh, Odisha, Uttar Pradesh, Karnataka, Assam and Maharashtra. It is also grown in Haryana, Madhya Pradesh, Kerala, Gujarat and Kashmir Valley (<http://www.gktoday.in>). The total agriculture production of India is shown in (Table 2)

Table 2: The total agriculture production of India

S.N.	Season	Season	Area in Million Hectares	Production in Million Tonnes	Yield in Kg/Hectare
I	Food Grains				
	Rice	Kharif	40.0	72.3	1,808
		Rabi	3.8	11.1	2,921
		Total	43.8	83.4	1,904
	Wheat	Rabi	26.7	68.8	2,577
	Coarse Cereals	Kharif	24.0	25.7	1,071
		Rabi	6.8	6.3	933
		Total	30.8	32.0	1,039
	Jowar	Kharif	5.3	5.8	1,094
		Rabi	5.4	3.3	606
		Total	10.7	9.1	850
	Bajara	Kharif	9.6	7.5	779
	Maize	Kharif	5.7	9.3	1,637
		Rabi	0.6	1.5	2,651
		Total	6.3	10.8	1,714
	Pulses	Kharif	10.6	5.0	473
		Rabi	12.5	9.0	720
		Total	23.0	14.0	609
	Gram	Rabi	7.6	6.1	805
	Tur	Kharif	3.4	2.4	704
	Total food Grains	Kharif	74.5	102.9	1,381
		Rabi	49.7	95.3	1,916
		Total	124.2	198.2	1,596
II	Cash Crops				
	Oil Seeds				

	Ground	Total	7.4	8.4	1,135
	Rapeseed and Mustard	Rabi	6.7	5.7	849
	Soya bean	Kharif	5.9	6.3	1,068
	Sunflower	Total	1.9	1.1	582
	Total oil seeds		26.4	23.6	896
III	Other Cash Crops				
	Sugarcane		4.1	284.3	70,019
	Cotton*		9.1	12.4	232
	Jute & Mesta**		1.1	10.6	1,778
	Potato		1.2	21.5	17,231
	Onion		0.4	4.3	1,035
	Coconut***		1.9	135.7	7,142
	Tobacco		0.5	0.7	1,455

Where

- * : Production in million Bales of 170 Kg each.
- ** : Production in Million Bales of 180 Kg each.
- *** : Production in '00 Million nuts and Yield in number of nuts.

Source: - Agriculture Statistics at a Glance- 2000, Directorate of Economics and statistics, ministry of agriculture, Govt. of India, New Delhi, April 2000

The soil and climatic conditions are suitable for the production of horticultural crops. Mango (*Mangifera indica*), Pineapple (*Ananas comosus* Merrill), litchi (*Litchi chinesis* Sonn.), guava (*Psidium guajava* Linn.), Banana (*Musa paradisiacal* Linn.) and jackfruit (*Artocarpus heterophyllus* Lam), are grown at low altitude, and on the high altitude major crops are orange (*Citrus reticulate* Blanco), plums (*Prunus domestica* Linn.), peaches (*Prunus persica* Batsch) and pears (*Pyrus communis* Linn.). Fotapioca (*Manihot esculenta* Crants) is grown on the Khasi hills Meghalya India and turmeric (*Curcuma domestica* Valetton) are grown in Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra, Orissa, and Kerala. It requires a warm and humid climate. It succeeds the best on loamy or alluvial, loose, friable and fertile soils.

IRRIGATION PRACTICES

Irrigation play very vital role to enhancement of productivity yield per unit of areas. Its provide appropriate moisture of crops land then crops to obtain most favorable and continuous crop yields with maximum economy in the use of water as input (Dhawan, 1998). Irrigation also helps to minimize the unemployment problem and increases the labour charge both of which are essential to reduce the poverty among the landless labour households (Saleth, 1997). Though, water scarcity vigorous increases world wide due to several reasons (Rosegrant, et al., 2002).

**Table 1 has summarized the percentage of area brought under irrigation as a function of years (Rajapure.and Kothari, 2012)
Year Area under irrigation (%)**

Year	% of Area
1950-51	18.1
1960-61	19.1
1970-71	24.1
1980-81	29.7
1990-91	35.1
2000-01	43.4
2010-11	47.5

Source: Dept. of Agriculture and Cooperation, Agricultural Census Division, 2010.

India cultivates annually 1-3 crops on its 125 million hectares of agricultural land, exclusively depending upon the availability of water for irrigation. Irrigation accounts for about 55-70% use of water in India. Due to unawareness of the cost: benefit ratio in using modern irrigation practices, out of available water, almost 60% used in irrigation is wasted. According to WHO estimate, in India agriculture uses as much as 70-90% of all renewable water resources that are now gradually diverted to human use. The net area under irrigation by tanks declined from 2.46 million hectares in 2000-01 to 1.64 million hectares in 2009-10, whereas, net area under irrigation by tube wells and other wells enhanced from 33.83 million hectares in 2000-01 to 39.04 million hectares in 2009-10. Net area under irrigation by other sources enhanced from 2.91 million hectares in 2000-01 to 5.88 million hectares in 2009-10. The net areas under irrigation by sources in hect. (Fig.2). In India flowing type of irrigation are implemented

Rain-fed irrigation: - It is accounted 75-90 million hectares of land in India (Rajapure and Kothari, 2012). India is largest producer, processor, consumer and importer of different leguminous crops. These crops are Munga (*Vigna radiate*), Urad (*V. mungo*), soybean, cowpea (*Vigna unguiculate*), arhar (*Cajanus cajan*) etc.

Munga (*Vigna radiate*), Urad (*V. mungo*), are totally depend on the rain-fed irrigation and Soybean needs intense irrigation for at least one month, cowpea (*Vigna unguiculate*) requiring for 2-3 months and arhar (*Cajanus cajan*) required irrigation for 4-5 months.

Surface/flood irrigation: - In surface irrigation systems, water moves over and across the land by simple gravity flow in order to wet it and to infiltrate into the soil. Surface irrigation can be subdivided into channel, border strip or basin irrigation. It is often called flood irrigation when

the irrigation results in flooding or near flooding of the cultivated land. Flood irrigation is only about 35 to 40 percent of water use efficiency because of huge transportation and allocation losses (Rosegrant, 1997; INCID, 1994).

Dip irrigation: - Due to water crisis dip irrigation is required for world. It is utilized to reduce water consumption along with cost of cultivation and improving productivity of crop. yield incensement notice through drip method of irrigation is over 40% in vegetable crops such as bottle gourd, potato, onion, tomato and chillies, whereas the same is noticed over 70 percent in many fruit crops. Yield difference is also found to be over 33 percent in sugarcane cultivated under drip irrigation over the same crop cultivated under flood irrigation. These experiments carried out at Punjabrao Krishi Vidyapeeth (Akola, Maharashtra State) on 7 vegetable crops such as cauliflower, tomato and brinjal also suggest that productivity enhancement due to drip irrigation.

Rice based agriculture practices

Such type of agriculture supported Indian agriculture and ensuring the food security. India occupies 10 millions ha of land to practices of rice based cropping systems and rice-wheat systems (Woodhead et al., 1994) generally in the Indo- Gangetic belt. In this system farmers grown rice mainly in rainy seasons parallel to summer months, pursuing by wheat in the winter. Other parts of country rice are pursuing by pulses, oilseeds or even vegetables as per the leading cropping system of the area (Adhya et al., 2007).

Tea based farming practices

This type of agriculture is mainly practices in north-east states of India. Some timber is yielding shade trees, *Aquilaria agallocha* Roxb. and *Alnus nepalensis* D. Don along with *Piper betel* Linn. *Piper nigrum* Linn. are grown with tea plantation.

Bamboo- arecanut- betel based farming practice

India is the second largest bamboo producer of the world. Bamboo is cropped in large amount of north eastern states of India. it is grow well in tropical warm temperate climatic conditions, however, it does not prefer temperatures under 15⁰C in summer. It is grown in wide range of soils except in rocky soils. Bamboo plantation requires well drained sandy loam to clay loam soils with pH ranges of 4.5 to 6.0 in India (<http://agrifarming.in>).

Bamboo is prominent practices in some isolated pockets of North eastern part of India. Arecanut (*Areca catechu* Linn.), bamboo species (*Bambus tulda* Roxb., *Bambusa pallid* Munro, *Bambusa*

balcooa Roxb., *Dendrocalmus hamiltonii* Nees and Arn., *Neohuzeaua duloa* A. Camus, *Melocana Baccifera* Kurz.) and *Piper betel* Linn. are cultivated together in these practices (Bhatt et al., 2002).

Soil Management Practices

Soil is the one of the one of the best natural resources that performs many functions essential for maintenance of ecosystem, especially forest. It is the wonderful gift of nature man than soil (Singh 2002; Singh 1990). Agriculture starts with vigorous soil that holds water and nutrients and provides a steady base to maintain plant roots (Mishra, 2013). India has different climatic condition and according to ICAR has classified soils in different groups these groups are Alluvial soils, Black soils, Red soils, Laterite soils, Arid soils, Saline soils, Peaty and Organic soils and forest soils (Pushpanjali et al., 2013).

Due to different climatic condition state wise soil management is done like North Eastern states of India soil management in traditional way. These techniques are zabo system of terrace farming in Nagaland (Gokhle et al., 1985). Bench terracing cultivation in sikkim and Panikheti in Nagaland; bamboo drip irrigation system of jowai in Meghalaya (Nene, 2009) and the sustainable land and water management system practiced by Apatanis in Arunachal Pradesh (Chaudhary et al., 1990). In Andhra Pradesh farm- yard manure and green manure from plants such as kanuga (*Pongamia pinnate* (L) Merr.), Vempali (*Tephrosia purpurea* Pers.), and jilledu (*Calotropis gigantean* (L) R.Br.) were used in paddy fields. Farm-yard manures uses on the dry land for maintaining the soil health (Padmaiah, 2001).

CONCLUSION

In India about 70% of rural population directly depends on agriculture, 52% in total number of jobs and 18.1 % in Indian GDP and about 43% of India's geographical areas are using in agriculture activity. Some Indian states which economy and development depended on the agriculture, these states are Punjab, Uttar Pradesh, Madhya Pradesh, Haryana, Bihar, Andhra Pradesh, Maharashtra, West Bengal, and Gujarat. Mostly Indian people practices subsistence and plantation agriculture and at present they were also depend on monsoon for irrigation, drip irrigation is adopted most part of India. And for soil management crop rotation and mixed crop are practices. Due to this soil become fertile and also stop the soil erosion and in the same time people also get double benefited like in the same filed two or more crops cultivate and get sufficient amount of grains.

REFERENCES

- Adhya T.K., Pathak, H. and Chhabra, A.(2007). N-Fertilizers and Gaseous- N Emission from Rice-Based Cropping Systems. Agriculture Nitrogen use and its Environmental implications. Editors. Y.P. Abrol, N.Ranguram, and M.S. Sachdev. International publishing house Pvt. Ltd. New Delhi. 459-476.
- Aiyer, A.K.Y.N. (1949). Mixed cropping in India. Indian Journal of agriculture sciences. 19, 439-543.
- Arjun, K. M. (2013). Indian Agriculture- Status, importance and role in Indian economy. International journal of agriculture and food science technology. <http://www.ripublication.com/ijafst.htm> 4(4), 343-346.
- Bhatt B.P., Singh K., and Mishra L. K., (2002). Tree based farming systems, in: integrated watershed Management for sustainable Development, (ICAR Research Complex for NEH Region, Umiam, Meghalaya), 176.
- Borthakur D.N. (1982). Agriculture in the 1980's: strategy for development in the potential areas- North Eastern Hill Region, Paper Presented at the Silver Jubilee Conference of Agriculture Society of India, Calcutta.
- Chaudhary, R.G., Dwivedi, R.N., Prasad, R.N. and Dutta, K.K. (1990). Research needs for land and water management for enhancing agriculture production in Arunachal Pradesh. In: proceeding of the workshop on research needs on land and water management for enhancing agriculture production in Eastern Region. Water technology center for eastern region, Bhubaneswar, Orissa, India, 93-120.
- Dhawan. B.D (1988). Irrigation in India's Agricultural Development: Productivity, Stability and Equity, Sage, New Delhi
- Dumanski, J., Peiretti, R., Benetis, J., McGarry, D., & Pieri. C. (2006). The paradigm of conservation tillage. Proceedings of World Association of Soil and Water Conservation, P1, 58-64.
- Gokhle, A.M., Zeliang, D.K., Kevichusa, R., Angami, T., and Bendangnungsang, S. (1985). The use of Alder trees. State council of education research and training, education department government of Nagaland, Kohima, Nagaland, Indian 20.

Government of India. (2000). Guidelines for watershed development project in shifting cultivation areas, ministry of Agriculture, New Delhi.

<http://agrifarming.in/bamboo-farming>.

<http://agricoop.nic.in/imagedefault/trade/Rice%20profile.pdf>

<http://drd.dacnet.nic.in /Status%20Paper%20-%2002.htm>

<http://www.gktoday.in/major-crops-of-india>

<http://www.nios.ac.in/media/documents/secsoescicour/english/lesson-12.pdf>

IBEF (2015). Indian agriculture industry; an overview. <http://www.ibef.org/industry/agriculture-india.aspx>

Hari K, K. K. (2014). Agriculture updates by SMS- A cloud computing approach. Proceedings of the international conference on cloud computing and eGovernance (ICCEG). ISBN: 978-81-929742-2-4.

International Federation of Agricultural Movements (IFOAM) General Assembly (2013). A project of the sustainable organic agriculture action network. Guidelines for regenerative and sustainable social, environmental, economic, and cultural development.

Jeeva, S.R.D.N., Laloo, R.C. and Mishra B.P. (2006). Traditional agriculture practices in Meghalaya, North East India. *Indian Journal of Traditional Knowledge* 5(1), 7-18.

Kassam, A. H., & Friedrich, T. (2009). Perspectives on Nutrient Management in Conservation Agriculture. Invited paper, IV World Congress on Conservation Agriculture, New Delhi, India. 4-7,

Mishra, A.K. (2000). Alternatives to shifting cultivation. Lecture delivered in Course on Agricultural Development in Northeastern States, NIRD-NERC, Guwahati.(22-26 May).

- Mishra, A.K. and Sharma. U.C. (2001). Traditional wisdom in range management and environment conservation in Northeastern region of India. *Himalayan ecology and development*. 9(1), 27-32.
- Mishra, M. (2013). Role of eco-friendly agricultural practices in Indian agriculture development. *International Journal of Agriculture and food science technology. (IJAFST)*. 4, (2), 11-15.
- Mishra S., Chaudhury S.S., Swain, S. and Ray T. (2009). Multiple cropping system for conservation and sustainable use in Jeypore Tract of Orissa, India. 13 (1), 39-51.
- Mohler, C. L. and Johnson, S. E. (2009) *Crop Rotation on Organic Farms: A Planning Manual*, NRAES 177 editors Published by NRAES, www.nraes.org,
- Mondal, P. (2015). 3 Major types of Farming practices seen in India. your article library.
- National portal content management team. (2011). *Horticulture: Plantation crops*. <http://www.archive.india.gov.in/sectors/agriculture/index.php?id=24>
- Nene, Y.L. (2009). Indigenous knowledge in conservation agriculture. *Asia agri-history*, 2(4), 321-326.
- Padmaiah, M. (2001). Past and present Experiences of an elderly farmer in Andhara Pradesh. *Asia Agri- History*, 5(1), 211.
- Papendick R.I., Sanchez P.A. and Triplett G.B. (Eds). (1976). *Multiple Cropping*. ASA Special Publication No. 27. American Society of Agronomy, crop science society of America, and Soil science society of America, Madison. Wisconsin, USA.
- Poisot, A. S., Speedy A. and Kueneman E. (2004). Good agriculture practices- a working concept. Background paper for the FAO Internal workshop of good agriculture practices. <http://www.fao.org>.
- Pushpanjali, Samuel J. and Rejanir (2013). Traditional knowledge for soil management India. *Best: Internatioanl Journal of Huminites, Arts, Medicine and Science (Best: IJHAMS)*, 1(2), 39-44.

- Rajapure, V. A. and Kothari R.M. (2012). Sustainable irrigation practices in India, Irrigation system and practices in challenging environments. Dr. Teang Shui Lee (Ed.) www.intechopen.com.
- Ranganathan R. (1993). Analysis of Yield advantage in mixed cropping. Landbouwniversiteit Wageningen, Wageningen, the Netherlands. 99.
- Redman, M. (2010). Assessing the impact of rural development policies (incl. LEADER). Deliverable D 8.1: Case study report. Funded by the 7th Framework Programme for Research and Technology Development of the European Commission.
- Rosegrant, W. Mark (1997), Water Resources in the Twenty-First Century: Challenges and Implications for Action, Food and Agriculture, and the Environment Discussion Paper 20, International Food Policy Research Institute, Washington D.C., U.S.A.,
- Rosegrant W. M.; Ximing Cai and Sarah A. Cline (2002), World Water and Food to 2020: Dealing with Scarcity, International Food Policy Research Institute, Washington, D.C., USA and International Water Management Institute, Colombo, Sri Lanka.
- Saleth, R. M. (1997). Irrigation Induced Indirect Employment during Eighth Plan: An Estimation Procedure with Tentative Estimates, The Indian Journal of Labour Economics, 40, (2). 279-288.
- Sharma S.D., Tripathy S. and Gurung P. (1998). Case study- Jeypore tract, Orissa. In: Gender dimensions in Biodiversity Management (Swaminathan MS, ed.). Konark Publishers, New Delhi, India. 123-138.
- Singh B. and Saika B.P. (1990). Water table control through pipe drains in tea soils, in: tea research global perspective, (Proc Int Conf Res Dev Tea), 74.
- Singh G., Singla, S.K. and Reddy L.S. (2013). Checklist of commercial varieties of plantation crops. Government of India. Ministry of Agriculture. Macro Graphics Pvt. Ltd. www.macrographics.com.
- Singh J.L. (2002). Agri-hort-silvipastoral systems on the hills, in integrated watershed management for sustainable development, (ICAR Research Complex for NEH Region, Umiam, Meghalaya), 130.

- Singh N.P. Saxena D.C.(2002). Agropastoral and agro- horticultural system in hills, in: integrated watershed management for sustainable development, (ICAR Research Complex for NEH Region, Umiam, Meghalaya). 138.
- Singh R.K., (2002). Soil conservation measures in agricultural land, in integrated watershed management for sustainable development, (ICAR Research Complex for NEH Region, Umiam, Meghalaya) 104.
- Tripathi, N., Singh, R.K., Pal, D. and Singh R.S. (2015). Agroecology and sustainability of agriculture in India: An overview. *EC Agriculture* 2(1), 241-248.
- Woodhead T., Huke, R., Huke, E., and Balababa, L., (1994). Rice- wheat atlas of India. IRRI/CIMMYT/ICAR publication, Los Banos Phillipines.
- Yadav, P.K. and Kaneria. (2012). Shifting cultivation in North-East India. 2nd National Conference on Environment and Biodiversity of India, held in New delhi.
- Willey R.W. (1979). Intercropping- its importance and research needs. Part I. Competition and yield advantages. *Field crop Abstracts* 32, 2-10.