

# PERSPECTIVES ON ENVIRONMENT DEGRADATION AND AGRARIAN CRISIS IN INDIA

Edited By

**Dr. Onkar Basal**

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Proceedings of Seminar on  
**PERSPECTIVES ON ENVIRONMENT DEGRADATION AND  
AGRARIAN CRISIS IN INDIA**

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## **PREFACE**

Economic development during post reforms period have drastically change an environment of the country. According to the models of economic growth and development; development at the cost of environment will never helps to achieve the goal of inclusive and sustainable development. Mere negligence of the agrarian and environmental issues in the policy domain will further worsen the situation. Day by day declining quality of the environment will leads to the multiplier effects on the factor productivity. This has further increase in the cost of production as well as declining production. And lastly it has resorted at the grave issues like unemployment and inflation. In this situation the agrarian community suffers badly.

Agrarian relations in India had undergone a sea-change during the period of green revolution in general and to that of last two decades of economic reforms in particular. One of the serious outcomes of these changes is the incidence of suicides of farmers in different states of the country. Changes in agrarian relations occurred due to the changing policies and change in ecology. Changing macroeconomic policies and other changes led to the gross neglect of agriculture consisting of 60 per cent of the population and one fifth of the electorate. This took agriculture and rural economy towards distress. The number of suicide cases in rural parts has been mounting in last fifteen years. During the period of 1995 to 2012 (2, 87, 967) farmers has been committed suicide in the country. Since the mid 1990s, large section of farm households have been facing a distress as a consequence of decline in agricultural income and loan repaying capacity and increased debt burden. Rain-fed areas are particularly prone to year to year fluctuations in production and degradation in environmental resources. In the present book we tried to analyze and criticize the reciprocal relationship between the agrarian reforms and environmental degradation. As well as it also focuses on the functional relationship between climate changes, declined agricultural productivity, unremmunarative profession and thereby agrarian crisis and farmers suicides in India.

**Onkar Rasal**

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## **Agrarian Crisis and Farmers Suicides: A Ground Reality of Maharashtra**

Onkar Rasal\*

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### ***Abstract***

**‘Agriculture is the backbone of the Indian Economy’, a world known phrase for the Indian economy. It is widely acknowledged by the academicians and policy makers that the growth of agriculture sector is the prerequisite for the inclusive development of an economy. It was also mentioned by the several economists in the growth models i.e. Gunnar Myrdal, Rostow, Libenstein and also found in the Gandhian perspective of economic development. But what seems to be happened in Indian economy over the last two decades. During past two decades majority of farmers have become poor and harried outcasts in their own country with no respectful place in the economic policy. Agriculture has become a relatively unrewarding profession causing abandoning of farming and increasing migration. It brings out the fact that something is terribly wrong in the countryside (Swaminathan-2006). The farm economy of the country is at the back foot during the reforms period. The mismatch between the increasing aspirations of the rural masses and the inability of the State and its economic model to satisfy these aspirations is not new. But the gap seems to be widening significantly after the launch of economic reforms in the early 1990s. There is no doubt that the growth process of the Indian economy has been highly impressive and that many of the macroeconomic indicators have also been equally impressive. According to the neo-liberal economic theory, such a growth performance should have resulted in the trickling down of benefits to the lower section of the society thereby lifting the laboring poor out of the poverty and various forms of deprivation. But the gap between income and expenditure of agriculture as well as the gap between the incomes of rural and urban has been widened during the reforms period. It has an outcome of the declined farm and factor productivity and lack of, off farm employment opportunities. On the other hand the development policies are urban centric. Nonetheless, we are far away from the goal of inclusive development. The present paper focuses on the factors that are responsible for the declining agricultural productivity and deterioration of the rural and agrarian economy. It also points towards the impact of the deterioration of farm economy on the inclusive development of the Indian economy. The present paper will focus on the issue of agrarian crisis and dismal act of committing suicides by the farming community in the countryside.**

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***Key Words:- Agrarian Crisis, Farmers Suicides***

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## **Introduction**

**Indian agriculture has never been a profession of profit. As has been pointed out by Amartya Sen (1962, 1964), if the family members working in agriculture are given an ‘imputed Value’, most of the Indian agriculture will turn to be an unremunerative. Agrarian relations in India had undergone a sea-change during the period of last two decades of economic reforms. Changes in agrarian relations occurred due to the changing policies and change in agricultural market. Changing macroeconomic policies and other changes led to the gross neglect of agriculture consisting of 53.6 per cent of the population and one fifth of the electorate. This took agriculture and rural economy towards distress. Since the mid 1990s, large section of farm households have been facing a distress as a consequence of decline in agricultural income and loan repaying capacity and increased debt burden. Rain-fed areas are particularly prone to year to year fluctuations in production and degradation in environmental resources. In the liberalized market, farmers are exposed to price volatility because of fluctuations in domestic production and international prices of agricultural commodities. The most serious aspect of this crisis is deceleration in agricultural growth with distress state of farmers in general and that of small and marginal in particular. The issue of farmers indebtedness become a matter of intense debate whenever agricultural sector faces distress. But, indebtedness is not the root cause of the current crisis. The factors that are responsible for indebtedness are vital in this phenomenon. The declined or mere stagnation in agricultural productivity, increasing production and marketing risks, institutional credit shrunk, increase in cost of cultivation and lack of alternative opportunities of employment at countryside are causes for the indebtedness and thereby pathetic act of committing suicides. The ‘Demonstration Effect’ has been observed among the farmers either in production or consumption practices.**

## **Conceptual Framework**

**A plethora of writings is available on farmers suicides bringing out reasons for the crisis and the suicidal behaviour of farmers in India. Most of the studies that have been conducted by scholars focused on the states of Maharashtra, Punjab, Kerala, Karnataka and Andhra Pradesh which are most affected by farmers suicide in the country. In fact the situation assessment survey of farmers carried out during the year 2003, by the National Sample Survey Organization of India, brought out several startling findings on farm level crisis. The survey revealed that more than half of the Indian farmers were in debt and much of the debt was a consequence of the gap between agricultural expenses and returns from it. As a result, the agricultural activity has become an unrewarding profession in a generally unfavourable price regime. Surinder Jodhka in a study on farmers suicides in Punjab highlighted the decadal changes in policy and agrarian situation and held it responsible for the suicide of the farming community. When there was a bumper crop of Paddy with favourable natural conditions, government was not ready to buy at the minimum support price and this led to further distress (Jodhka 2005). There has been a general stagnation in the agriculture sector over the last two decades which pushed farmers into distress (Govt. of Punjab 2004). Cash expenditure on crop production has been steadily rising for different crops while the prices have shown a declining trend. The compound growth rate of cash expenditure between 1974-75 and 1991-92 was nearly 9 per cent for Wheat and more than 11 per cent for Paddy in Punjab (Shergil 1998). This type of a situation causing indebtedness has been identified as a major cause for the crisis.**



**Borrowing from informal sources invites trouble for farmers. Studies by Gill and Kaur (2002) pointed out that the middlemen (*arthyas*) are the major source of credit for farmers in Punjab. The purpose of borrowing found that farmers borrowed for both the “productive” (41%) and “unproductive” (59%) purposes whereas the present study finds that in Maharashtra 83.16% of farmers borrowed for productive and 16.83% for the non-agriculture unproductive purposes. The agrarian scenario in Maharashtra has also changed fast. Srijit Mishra (2006) discussed the agrarian crisis that has precipitated a spate of suicides in the state. In Maharashtra the contribution of agriculture to GSDP has come down from 40% in 1960-61 to 13% in 2004-05 but the population dependent is still 58.5 per cent. Deshpande (2002) in a study on farmers suicides in Karnataka, brought out the agrarian distress and debt of farmers as a major cause for the curse. P. Narsimha Rao and K. C. Suri (2006) in a combined study on dimensions of agrarian distress in Andhra Pradesh pointed out that it was a debt burden that pushed farmers into the suicide trap. High cost of cultivation, diminishing productivity, and low returns make farmers further difficult to withstand crop failures and lead them to distress. S. Mohankumar and R. K. Sharma (2006), in an analysis of farmers suicides in Kerala, concluded that agrarian crisis and farmers distress are closely linked to the neo-liberal policy regime implemented in the country during the 1990s. V. Shridhar (2004) writes that farm individuals and communities are under pressure to cope with the changes brought about by a churn in socio-economic conditions in Andhra Pradesh. Some other studies covering various aspects of farmers’ suicide are by Assadi Muzaffar (1998), Kumar Pramod and L S Sharma (1998), Bhalla G S (1998), Patnaik Utsa (2002), Choudhary (2002), Govt. of Kerala (2004), Shridhar V. (2004), Deshpande and Prabhu (2005), Mohanty B B (2005), Mohankumar and Binni (2005), Sainath P. (2007), Dandekar et. al. (2005), M S Swaminathan (2006), Gnyanmudra (2007), etc. International academic development process has also given an equally adequate amount of attention to the studies on suicides. The beginning is contributed by a known sociologist like Durkheim (1951). The study known as; Suicide: A Study in Sociology where he discovers socio-psychological factors that lead the causation analysis of suicidal behaviour. Recent studies on suicides in the world have stressed more on economic aspects and macroeconomic policy changes. Studies have attempted to assess the impact of change in macroeconomic policies of countries and its impact on socio-economic relations in urban and rural agrarian economy and its dominance in the suicidal causes. Stone G.D. (2002) studied the impact of Biotechnology on agrarian situation and farmers distress leading to suicides. Murphy, Lilliston and Lake (2005) assessed the agrarian distress from the WTO and Agreement on Agriculture (AoA) point of view and studied the impact of a decade of United States dumping on agriculture markets and thereby agriculture prices and cost benefit effectiveness in developing economies. The foregoing analysis clearly shows that recent studies on suicides in the world have become farmer centric and the determining factors vary from the changing political economy to the macro-economic policies, change in technology, impact of neo-liberal policies and the role and dominance of advanced countries in the world agriculture market.**

**The agrarian crisis in India has both long term structural and institutional as well as short term manifestations. The long term structural features indicate sharp decline in the share of agriculture in the Gross Domestic Product (GDP) accompanied by very low rate of labour force diversification away from agriculture. This has resulted in declining relative productivity of agriculture and non-agriculture sector. The growth rate of agriculture has**

decelerated noticeably during the post reforms period. The crisis has been exacerbated further by rapid environmental degradation and plate aging the existing agricultural technology. The liberalization of economy has failed to give a big push to agriculture sector and to increase income and employment in agriculture. The gradual withdrawal of state from active participation in development activities has resulted in sharp decline in public investment in agricultural infrastructure in general and agriculture science and technology in particular. This has resulted in deterioration of rural infrastructure; decline in factor productivity in farm economy and thereby stagnation in rural development particularly during the post reforms period.

Although, almost all the regions of the country have experienced a deceleration in their agricultural growth, the adverse impact is especially serious in rain fed regions and among small and marginal farmers. The income from agriculture had been declined with increased cost of cultivation. However, the institutional credit supply dried up and farmers resorted at private moneylenders for their credit needs. The moneylenders took disadvantage of the footloose situation of farmers and charged heavy rates of interest on loan amount doubling the principal amount within a year or two. The situation further aggravated during the post reforms period.

The present agrarian crisis is closely associated with the misapplication of the macroeconomic policies towards agriculture during the post independence period in general and that of the post reforms in particular. The blindly following of the developmental policies of the developed countries has an adverse impact on the agriculture sector of the country. The innovation in the agriculture during the 1960s expected an inclusive growth of the sector as well as economy but has been limited to few crops (Paddy and Wheat) and in few states i.e. Punjab and Haryana. The increase in the agricultural credit remains only on paper and in real terms it has been stagnant over the decades. The co-operatives are far away from their target group i.e. small, marginal and weaker sections of the agrarian community. However, the institutional structure of agricultural produce marketing failed to address the farming community and became a play ground for the new comers in the politics. The functioning of APMCs is like a private entity of the traders, whereas farmers are the mute receiver. This is the situation of the domestic institutional marketing mechanism of agricultural produce. Whereas, at international level, farmers have to face the international market competition without State support. Government withdrew the institutional support through reduction in import duties during the 1998 to 2001 from earlier 35 to 5 per cent. At the same time developed countries continuously support their farmers through direct subsidies under different schemes. Over the years, Indian government reduced the volume of indirect subsidies to the agriculture sector. It has resulted into increase in the cost of cultivation and the mere stagnant or declined support prices caused for the increase in the gap between income and expenditure.

In all, declined factor and crop productivity and thereby deterioration of agrarian economy in the country has the positive correlation with the agricultural and macroeconomic policies since the independence in general and post reforms in particular. It has been the negative impact on the inclusive development in India.

### **Agrarian Scenario in India**

The agricultural development in India essentially involves five important phases. The first phase involves the period prior to independence of the country. This period was marked by

the retrogression of the sector and ended by leaving the country with perhaps the world's most refractory land problem. The second phase of development of agriculture sector covers the period of independence influenced both by the indigenous thinking about development i.e. Gandhian Perspective and also the western process of growth borrowed from the industrialized countries. This phase ended with the drought of mid-sixties when food security and acute poverty became prominent issues. The third phase consist the Green Revolution after the mid-sixties. Afterwards India not only met the domestic requirement of food but also became a net exporter of food grains particularly the Wheat and Rice. This was the success of the technological changes of the 1960s. This should be equally credited to the participation of farmers in readily accepting technological innovations along with the availability of new inputs. The role of farmers in the process of the spread of technological changes is of prime importance but acknowledged or highlighted rarely. The half-clad, ill-fed and under-nourished farmer with strong resource constrains was fully charged to provide food security to the country and to prove wrong the predictions of a widespread famine by the western economists. Therefore, the achievements of the technological change were possible only due to the farmers' positive role and whole-hearted participation in the process. This was followed by two distinct phases of growth, i.e. the immediate fall-outs of technological change and the phase of new economic policy.

At the time of independence, the agricultural economy of the country was clearly a stagnant with wide regional diversities, lower resource availability, inadequate institutional support and acute poverty. The policy makers then began with an optimistic note and recognized the problems at the outset. The farmers became the focus of reforms and increasing their efficiency became major objective. Farmers and food crops became the focus of the strategy during the period of Green Revolution. The technological changes focused on Cereals as a broad group and Paddy as well as Wheat as the vanguards of the revolution. The process involved providing essential resources for the transfer of the technology from lab to land along with extension support. In addition to this other support institutions also helped the technology to take roots in the farm i.e. price policy, agricultural education, extension services and provision of credit. All these presumed the farmer as a active participant, without really making the group as a part of decision making process at least overtly.

**Table- 01 Growth Rates in Area, Production and Productivity by Crop Groups in India (in per cent)**

Crop Groups		1949-50 to 1964-65	1967-68 to 1980-81	1979-80 to 1989-90	1999 to 2000-01
Food grains	Area	1.35	0.38	-0.11	-0.17
	Production	2.82	2.15	3.54	1.94
	Productivity	1.36	1.33	3.33	1.52
Non-Food-grains	Area	2.44	0.94	1.21	1.37
	Production	3.74	2.26	4.02	2.78
	Productivity	0.89	1.19	2.47	1.04
All Crops	Area	1.58	0.51	0.21	0.25
	Production	3.15	2.19	3.72	2.28
	Productivity	1.21	1.28	2.99	1.31

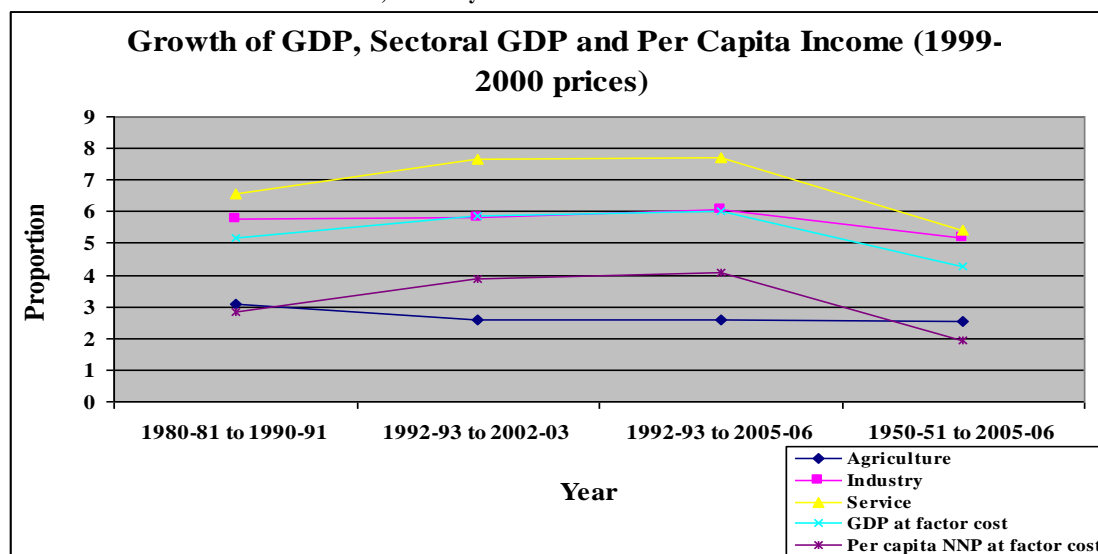
Source: Government of India(1999)Agricultural Situation in India, Directorate of Economics and Statistics

It comes out clearly from data that the non-food crops dominated the growth in the crop economy during 1949-65 and the growth in the production of food crops came mainly through the expansion of area. Growth in productivity of food crops was quite low indicating little gains due to technological innovations during that period. The situation changed after the introduction of new technology. Growth of food-grains was quite impressive. It was food-grains, which contributed mainly to the crop economy, and the growth came out of improvement in yield per hectare. The growth rates in production of food-grains stayed ahead of the growth rates in population in following decades thereby ensuring certain minimum per capita availability of food-grains. The expansion in area under foodgrains more or less ceased by 1980s and growth in production was clearly visible during eighties and nineties. Yield improvement is seen during the seventies and the second spurt in the growth is visible around the late eighties. Production and productivity seem to be stagnated in the post 1997 period. The gains of technological changes were incurred in a few states and for a few crops. A large portion of the farming community was out of the technological changes during the mid1960s. As a result, the gains from the innovation were not as per the level of expectation. And more vigorously small and marginal farmers were at the marginal in this new commercial agricultural practice.

**Table-02 Growth of GDP, Sectoral GDP and Per Capita Income (1999-2000 prices)**

Sr. No.	Year	Agriculture	Industry	Service	GDP at factor cost	Per capita NNP at factor cost
1.	1980-81 to 1990-91	3.08	5.79	6.54	5.15	2.82
2.	1992-93 to 2002-03	2.61	5.82	7.65	5.85	3.89
3.	1992-93 to 2005-06	2.57	6.05	7.72	6.00	4.10
4.	1950-51 to 2005-06	2.54	5.19	5.40	4.26	1.94

Source: CSO National Accounts Statistics, Various years



The most important manifestation of the crisis is deceleration of agricultural growth combined with increasing inefficiency in use of input and thereby adversely affecting the profitability of the sector. The growth rate of GDP from agriculture decelerated from 3.08 per cent during 1980-81 to 1990-91 to 2.61 per cent in 1992-93 to 2002-03. The growth rate of agriculture both in terms of GDP from agriculture and agricultural output has also decelerated in most of the states. Increasing share of service sector in GDP is an obstacle in sustainable development due to lack of creativity. Hence, sectoral transformation in the economy is required. Industrial sector has also shown an increasing trend during the mentioned period. But the share of service sector was high as compare to other sectors. Increasing share of the service sector in GDP indicates that the post reforms policies were more in favour of the same and adverse to the agriculture sector. As a result the economy is facing the problem of 'Jobless Growth' during reforms period. The negligence of the agriculture in the policy domain has reflecting by the declining share of the sector in GDP during the post reforms period.

**Table-03 Farmers Opinion about Agriculture as Profession**

States	Liking farming (%)	Not liking farming		Total (%)
		Not Profitable (%)	Others (%)	
Andhra Pradesh	75.4	16.7	7.5	24.2
Arunachal Pradesh	72.1	10.7	14.3	25
Assam	59	21.2	19.7	40.9
Bihar	48.6	35.5	15.3	50.5
Chhatisgarh	53.7	24.2	22.1	46.3
Gujarat	66.8	25.4	7.5	32.9
Haryana	60.3	29.9	8.4	38.3
Himachal Pradesh	64.6	18.4	16.7	35.1
J & K	61.5	20.9	17.6	38.5
Jharkhand	52.8	30.2	16.8	47
Karnataka	56.7	27.9	15.4	43.3
Kerala	66.6	27.9	5.1	33
Madhya Pradesh	59.5	21.4	18.9	40.3
Maharashtra	60.7	28.6	10.7	39.3
Manipur	67.4	28.2	4.2	32.4
Meghalaya	77.4	15.2	7.4	22.6
Mizoram	50.8	34.1	14.6	48.7
Nagaland	67.6	26.8	4.5	32.3
Orissa	53.1	33.8	12.9	46.7
Punjab	60.8	27.2	9.7	36.9
Rajasthan	61.2	21.5	17.3	38.8
Sikkim	64.6	30.2	5.2	35.4
Tamil Nadu	68.9	25	6	31
Tripura	52.5	20.2	25.1	45.3
Uttar Pradesh	58.8	24	16.5	40.5
Uttaranchal	46.8	42.3	10.9	53.2
West Bangal	53.8	35.4	10.1	45.5
All India	59.4	26.5	13.6	40.1

Source: NSSO (2005 a;, 2005b)



Farmers in India have perhaps reported willingness at first to leave agriculture as a profession provided that the substitute way of livelihood is available mainly because that the cultivation is no more remunerative. Overall proportion of the negative desire is of 40.1 per cent with Uttaranchal, West Bengal, Tripura, Uttar Pradesh, Karnataka, Maharashtra, Haryana and Andhra Pradesh leading the list. All the states from where farmers don't prefer agriculture is because it is not profitable to them due to increased cost of cultivation, stagnated productivity and mismatch between input and output prices. Unwillingness of farmers for agriculture profession has become a matter of concern because still we do not have the mechanism or substitute source to merge the farmers or say unskilled labour force. Already economy is facing the problem of informal sector labour and the trend among the farmers will further aggravate the situation. Hence, in future policy makers should take concern that to draft such a policy which will create the off farm employment opportunities in rural parts.

### **Agrarian Crisis In Maharashtra**

Maharashtra is considered as one of the progressive states in the country. The state has achieved the massive development in the field of agriculture particularly after the green revolution. Also Maharashtra was a pioneer state in adopting the new economic policy. At that time it was expected that the new economic policy will help in booming the economy in general and agriculture in particular. But, after the one and a half decade of the introduction of the new economic policy it was clear that the policy brought in the benefits to the industrial and services sector at the cost of agriculture and cultivators. The contribution of agriculture and allied sector to the net state domestic product at current prices declined from 40 per cent in 1960-61 to 13 per cent in 2004-05. According to census 2001 around 55 per cent of the total work force was either cultivators or agricultural labourers. For the period of 1993-94 to 2003-04, the growth rate of the Gross State Domestic Product (GSDP) at 4.8 per cent was lower than that of India's Gross Domestic Product (GDP) (5.8 per cent per annum). The eight major crop groups in terms of gross area under cultivation are Cereals with nearly half of it under Jowar, Pulses (3/10 under Arhar lentils), Fiber (mostly Cotton), Oil Seeds (nearly half of it under Soyabean), Sugar cane, Fruits and Vegetables, Condiments, Spices, Drugs and Narcotics etc.

There are four divisions in Maharashtra indicating the crop specialization. In which, Western Maharashtra consists Sugarcane, Wheat, Onions and other irrigated crops, Konkan region is famous mostly for Paddy and Fruits, Marathwada consisting Cotton, Pulses and Oil Seeds while Vidarbha cultivating mostly the Cotton, Arhar and Soyabean. Western Maharashtra is more irrigated as compare to rest of the Maharashtra. As a result, the income of the farmers of the Western Maharashtra increased and thereby standard of living through employment generation in agriculture sector i.e. Animal Husbandry, Dairy, Poultry and Goat Farming. Also the political leadership of Western Maharashtra has the greater say and dominance in the state policy as compare to other regions of the state. It is one of the reasons of the agricultural development of the region. The successful organisation of co-operatives also strengthened the efforts of the farmers in Western Maharashtra. However, the co-operative movement did not acquire expected success in Marathwada and Vidarbha regions of the state.

Disparities in development across Marathwada, Vidarbha and rest of the Maharashtra state have been a matter of socio-economic and political concern ever since the existence of separate statehood in 1960. After the formation of Maharashtra state in 1960, development

efforts continued in the three regions during the subsequent five year plans as expected in the Nagpur Agreement (SDBs Report- 2007). During the sixth plan (1980-85), State Planning department undertook a study on district wise development achievements and pointed to the noticeable disparities across regions in irrigation, roads, public health and technical education. During the sixth plan, government announced a 38-point, 35-point and 17 point development programmes for all three regions i.e. Vidarbha, Marathwada and Konkan mainly for the removal of the regional imbalance. Hence, the government set up a Fact Finding Committee (FFC) (1984) under the chairmanship of Prof. V.M.Dandekar to measure the nature and extent of the regional imbalance in the state of Maharashtra. The Fact Finding Committee worked out a total state backlog of Rs.3186.78 crore for 9 development sectors i.e. roads, irrigation, village electrification, general education, technical education, health services, water supply, land development and soil conservation and veterinary services. The FFC suggested its implementation through appropriate allocation of resources in the three regions to remove the backlog within 5-7 years. Though the government did not formally accept the FFC recommendations, it started allocating special outlays for removal of backlogs accumulated in the three regions from 1985-86 onwards. However, low budgetary outlays for the removal of backlog, inadequate deployment of implementing machinery and inequitable allocation of funds for non-backlog schemes resulted in the increase of regional imbalance. Which have been the negative multiplier effects on the regional economy. The Western Maharashtra has developed whereas Vidarbha and Marathwada regions remained backward. It can be called as a Backwash Effect of the development earlier mentioned by Gunnar Myrdal during the mid-1960s.

#### A Comparative Financial Backlog of Irrigation and Roads of Three Regions

Region	Sector	Years			
		1984	1994	2000	2002
Vidarbha	Irrigation	38.05	55.04	59.78	60.78
	Roads	48.55	42.68	38.78	42.53
Marathwada	Irrigation	22.85	32.37	32.85	33.08
	Roads	18.29	23.88	24.46	20.74
Rest of Maharashtra	Irrigation	39.10	12.59	7.43	6.24
	Roads	33.15	33.44	36.76	36.73

Source: Report on the performance evaluation of statutory development boards in Maharashtra 2003

The data in above table explains the regional financial backlog of irrigation and roads. Vidarbha region has consistently been at the altitude of financial backlog both in irrigation and roads. Whereas, rest of the Maharashtra showed a declining trend in the financial backlog of irrigation with 10 times less than Vidarbha and 6 times less than of Marathwada region. But the backlog in roads for rest of the Maharashtra shows increasing trend. However, Marathwada has the incremental financial backlog during the mentioned period. Irrigation and roads are the two wheels of the rural economic development and here the state government neglects both the sectors in general and for Vidarbha region in particular. Hence, the farmers of Vidarbha region remain dependent on uncertain monsoon for agricultural practices. As a result, uncertainty of income has increased and the farming community became more vulnerable. Farmers of this region have to spend more money on making of infrastructural facilities and less on actual cultivation purpose.

## The Ground Reality

Since 1997 the problems of agrarian crisis and farmers suicides have become an obstacle to the growth in general and that of rural economy of suicide dominant states in particular. It is widely acknowledged that the growth of agriculture sector is a prerequisite of achieving macroeconomic growth of the country. The problem of farmers suicides was aggravated in the country particularly after the second phase of the Economic Reforms i.e.1997-98. Most striking thing is that, the states which are agriculturally developed, suffer badly by the spate of farmers suicides. The green revolution of the 1960s and the commercialization of agriculture had sown the seeds of agrarian crisis and thereby farmers suicides in India. The problem is related to the ineffective implementation of the policy as well as unviable and uneconomical technology introduced in the country in general and during post reforms in particular. Looking at the overall spread of farmers suicides in the country, it is found that all category of farmers by size of holding, irrigated, dry land, cash crops and food-grains growers, etc. have been in suicidal trap. And the core issue of the distress act of suicides is unremunerative state of the agriculture and thereby mounting debt burden. The incidences of farmers suicide are found in Northern states like Punjab and Haryana and in Western parts of the country consisting Maharashtra, Gujarat and Madhya Pradesh and in Southern states like Andhra Pradesh, Karnataka, Tamil Nadu and Kerala. The geographical spread of farmers suicides clearly indicates that the farmers of all category and regions are affected of the distress. Therefore the entire Maharashtra was selected for the present study rather than a particular region or a district of the state. Maharashtra constitutes four regions. They are Western Maharashtra, Marathwada, Vidarbha and Konkan. Since the Konkan region did not have any reporting of farmers suicides therefore the study does not consist any information on the same. Hence the primary data based study consist Western Maharashtra, Marathwada and Vidarbha regions of the state. Most of the incidences of farmers suicides have been reported from the six districts of Western Vidarbha region of the state. These districts are Amravati, Yavatmal, Akola, Wardha, Buldana and Washim. Eastern Vidarbha is a tribal area and there is no direct dependence on agriculture hence the number of suicide cases has been far less than any other district of the region. It was decided to cover all regions of the state to understand the ground reality of the problem. The present study is conducted in Western Maharashtra, Marathwada and Vidarbha regions of the state of Maharashtra. In all, 200 farm households affected of suicide were selected from 9 districts, 24 tehasils and 166 villages on the basis of Simple Random Sample Method.

### Farmers suicides in Maharashtra 1997-2006

Sr. No.	Year	Number of Farm Suicides	Proportion to total No. of Suicide in State (%)	Proportion to total No. of Farm Suicide in Country (%)	No. of Male Farmers Suicide	No. of female Farmers Suicide
1	1997	1917	15.2	14.1	1600	317
2	1998	2409	17.6	15.0	1938	471
3	1999	2423	17.8	15.1	2050	373
4	2000	3022	21.6	18.2	2492	530
5	2001	3536	24.2	21.5	2945	591
6	2002	3695	25.4	20.6	3155	540

7	2003	3836	26.0	22.3	3381	455
8	2004	4147	28.2	22.7	3799	348
9	2005	3926	27.2	22.9	3638	288
10	2006	4453	28.7	26.1	4111	342
<b>Gross total</b>		<b>33364</b>	<b>26.3</b>	<b>20.1</b>	<b>29109</b>	<b>4255</b>

Source: K Nagraj MIDS,2008

The data on suicides reveal that, the problem of farmers suicides is acute and distressing in the state of Maharashtra. Over the ten years i.e. between 1997 and 2006, the number of farm suicides in the state has more than doubled from 1917 to 4453. It gives an annual compound growth rate of an exceedingly high figure of 9.8 per cent for farm suicides, here a rate at which the number would double every 7-8 years. Considering the period 1997-2006 as a whole, every fifth farm suicide committed in the country occurred in the state of Maharashtra. The problem of farmers suicides became more acute after the year 2003 and mostly the Cotton growing farmers were found in to the trap. The entry of private traders in Cotton procurement was the major reason of the distress among the Cotton growing farmers. Hereafter the gap between cost of cultivation and income has widened. And also the functioning of the government procurement became poor during that period. The private traders have their hold over these centers. The picture of male farm suicides in the state is even blacker. The male farmers suicides substantially increased than female in the mentioned period. It clears that the stress among the male farmers was severe than women.

### District Wise Number of Cases Studied by Gender

Region	Districts	Region total	No. of Tehasils	No. of Villages	No. of Cases Studied		
					Male	Female	Total
Western Maharashtra	Ahmednagar	34 (17)	07	33	33	01	34 (17)
	Marathwada	33 (16.5)	01	11	11	--	11 (5.5)
	Aurangabad		01	12	12	--	12 (6)
Vidarbha	Buldana	133 (66.2)	04	21	26	--	26 (13)
	Amravati		03	23	29	01	30 (15)
	Akola		02	34	50	02	52 (26)
	Yavatmal		01	10	10	01	11 (5.5)
	Washim		02	19	20	--	20 (10)
	Wardha		03	04	04	--	04 (2)
	<b>Total</b>	<b>200</b>	<b>24</b>	<b>167</b>	<b>195</b>	<b>05</b>	<b>200</b>

Source: Field Survey  
 Figures in parentheses indicate percentage

There are a number of reasons for highest number of reporting of farmers suicides from Vidarbha region of the state which consist six districts. The cropping pattern of the region is dominated by Cotton which has undergone various technological and institutional transformations, which made the crop more of unremmunarative of nature for cultivators. As is revealed by earlier studies that the technological changes in Cotton seed research in favour of GM varieties (BT Cotton) promised higher output per hectare and profit of rupees ten thousand. Ultimately it resulted in per hectare loss for rupees six thousand. Suicide cases have also been reported from other regions of the state which are covered under the present study. It revealed to us that the deceased families have been trapped in negative income as the agriculture has become unremmunarative for them. The basic reasons for the state of unremmunarative farming are the cultivation of commercial crops, stagnation of productivity (i.e. Sugarcane per acre productivity has declined to 27 m. tons in the sugar belt of Western Maharashtra), absence of irrigation and thereby more dependence on well irrigation with low water tables and low attainment of rural electrification in the state. Around 80 per cent of the state agriculture is rain fed and 64 per cent of rest of the 20 per cent of irrigated agriculture has a dependence on well irrigation and the irrigability of the same is determined by underground water table and the nature of the supply of rural electricity which are not at the satisfactory levels. The status of irrigation of Maharashtra shows a wide range of inter-regional disparities with Vidarbha region the lowest irrigation cover and highest irrigation attainment (expenditure) backlog (Danderkar-1984) ever since the separate statehood.

**Source Wise Loan and Rates of Interest Paid**

Sr. No.	Source	No. of Farmers	Proportion to total No. of farmer (%)	Amount (Rs.)				Interest Rate (%)		
				Maximum	Minimum	Total	Average	Max.	Mini.	Avg.
1.	Co. Op.	104 (37.14)	52	3,38,000.00	800.00	26,59,300.00 (27.98)	25,570.00	16	12	14
2.	Nationalized Bank	72 (25.71)	36	4,00,000.00	5,000.00	27,65,800.00 (29.10)	38,413.00	14	12	13
3.	Money lender	67 (25.71)	33.5	2,75,000.00	6,000.00	27,76,000.00 (29.20)	41,432.00	120	36	78
4.	SHGs	1 (0.35)	0.50	18,000.00	18,000.00	18,000.00 (0.18)	18,000.00	24	24	24
5.	Urban Co-Op.	12 (4.28)	6	2,05,000.00	10,000.00	10,05,000.00 (10.57)	83,750.00	19	10	14.5
6.	Sugar Factory	2 (0.71)	1	2,50,000.00	30,000.00	2,80,000.00 (2.94)	1,40,000.00	12	12	12
7.	No loan	06 (2.14)	3	--	--	--	--	--	--	--
8.	Information Not available	16 (5.74)	8	--	--	--	--	--	--	--
	<b>Total</b>	<b>280</b>				<b>95,04,100.00</b>				

Source: Field Survey  
 Figures in parentheses indicate percentage

Borrowing by farmers for agricultural operations and capital investments in agriculture is neither a new nor is it wrong but the use of credit, time, adequacy, price and resultant long term impacts of the same have wide range of repercussions on the lives of peasantry and farms. It is a fact that the performance of co-operatives and nationalized commercial banks



in agriculture credit could not wipe out the legacy of private moneylenders from the Indian countryside. Many research attempts on rural credit in India have noted the fact that the farmers receive discriminatory treatment by the nationalized commercial bank officials. And the co-operatives had never been free of political interference and historic record of unsatisfactory performance. The rural institutional credit sector of the country neither could eliminate nor has been able to control the lending rates and the dominance on lending by private moneylenders. It has been noted by our study that the proportion of suicide affected farmers borrowing from private moneylenders ranks at three (one third) in table no.7.34 with 33.50 per cent of farmers borrowing from them after 52 and 36 per cent of the farm households borrowing from co-operatives and commercial banks but both, the amount borrowed from and the rates of interest charged by moneylenders have been far higher than both the institutional sources. The average amount borrowed from moneylenders has been of Rs.41,432 whereas the same has been of the order of Rs. 25,570 from co-operatives and Rs.38,413 from the nationalized commercial banks with huge difference in the rates of interest the average of which comes out as 14 per cent by co-operatives, 13 per cent by commercial banks and 78 per cent by the moneylenders which can double the amount borrowed within a period of less than one year ( the maximum rates charged have been 16% by co-operatives, 14% by banks and 120% by the moneylenders). Despite the aforementioned usurious practices by moneylenders the farmers in the regions are not ready to reveal anything about them due to the strong hold the moneylenders retain on the rural farm economy and society on account of their ancestral dominance and the contemporary political links. But still the farmers borrow from them because loans are available on demand (which they term as Demand Loan) and they will have to pay commission to the tune of around 30 per cent of borrowing amount to agents at banks and co-operatives plus the time of processing is longer also the credit ability of them is at the bottom due to the pendency of earlier loans. For the purpose the agriculture sector it needs to be guaranteed for an adequate lending, strict observance of the performance of commercial banks in this direction and fulfillment of the statutory provision of lending of 18 per cent for agriculture by commercial banks.

### Reason and Source Wise Loan Obtained by Farmers

Sr. No.	Reason	Co-Op.	Nationalized Bank	Money lender	SHGs	Urban Co-Op.	Sugar factory	Total
<b>Agriculture Related Loans – (83.81)*</b>								
1.	Agri Exp.	91 (85.84)	32 (40.50)	24 (32.43)	--	04 (25)	--	151
2.	Seeds & Fertilizers	01 (0.94)	02 (2.53)	05 (6.75)	--	01 (6.25)	01 (50)	10
3.	Modern Agriculture Implements	05 (4.71)	08 (10.12)	01 (1.35)	01 (100)	03 (18.75)	--	18
4.	Irrigation	05 (4.71)	23 (29.11)	06 (8.10)	--	02 (12.5)	--	36
5.	Live stock	02 (1.88)	08 (10.12)	03 (4.05)	--	02 (12.5)	--	15

6.	Land Parching	--	01 (1.26)	01 (1.35)	--	01 (6.25)	--	03
<b>Non-Agriculture Related Loans- (16.18)**</b>								
7.	Housing	--	01 (1.26)	03 (4.05)	--	02 (12.5)	--	06
8.	Marriage	01 (0.94)	-	23 (31.08)	--	--	--	24
9.	Business	01 (0.94)	03 (3.79)	02 (2.70)	--	01 (6.25)	01 (50)	08
10.	Health	--	--	03 (4.05)	--	--	--	03
11.	Education	--	--	02 (2.70)	--	--	--	02
12.	Reason not Cited	--	01 (1.26)	01 (1.35)	--	--	--	02
	<b>Total</b>	<b>106</b>	<b>79</b>	<b>74</b>	<b>01</b>	<b>16</b>	<b>02</b>	<b>278</b>

Source: Field Survey

Figures in parentheses is percentage of total No. of respondent

\*, \*\* Proportion of deceased farmers obtained loans

Usually the society has a presumptive opinion about the unproductive use of farm loans but information cited in the above table makes it clear that most of the loans are borrowed and used for productive purposes. Hence it is clear from the study that the farmers does not make any unproductive use of loans which can bring an imbalance at their farm economy. 83.81 per cent of the farm households from where suicides reported have been found borrowing and strictly using the loan amount for agriculture related productive purposes such as investments, buying of implements, seeds and fertilizers, irrigation and on livestock. As has been noted in the foregoing parts the farmers incur more expenses because they need to spend on the infrastructure which is otherwise expected to be made available by the state investment which stands as merit public agriculture infrastructure such as irrigation, rural electrification and other extension facilities. For example, as there is no regular electricity many farmers have spent on buying of generators for energizing of pump sets and the additional expenditure on diesel for operating those generators has become a costly affair when they attempt to irrigate crops with inadequate state electricity infrastructure. Also spending on cattle or livestock takes place because of the scarcity of public animal hospitals. Only 16.18 per cent of the farmers were found borrowing for non-agricultural purposes but these borrowings also cannot be termed as unproductive borrowings which consisted health, education of children, attempt of non agriculture employment and housing. The borrowing for marriage for which the farmers have always been accused of has been found more from the moneylenders which is a matter of concern. But uncertainty of returns from agriculture and unavailability of basic infrastructure on the part of the government makes them to spend more and remains very little or often nothing for the household social responsibilities makes to borrow even for marriages but this activity being a significant part of the social life (and particularly when corporate houses, bureaucrats and politicians arrange for exorbitant spending on marriages of their children) cannot be called as unproductive one but on the contrary it is significant for the social pride of everyone in all societies in the world.

### Risk Factors Responsible for the Distress Act of Suicide

Sr. No.	Risk Factors	Total No. of Respondent	Proportion to Total (%)
1.	Deterioration of Social Status	79	39.5
2.	Economic Crisis	151	75.5
3.	Marriageable daughter/sister	82	41
4.	Indebtedness	178	89
5.	Family Discord wife/husband	16	08
6.	Discord with other Family Members	36	18
7.	Disputes with villagers	03	1.5
8.	Disputes with any one before the incidence	07	3.5
9.	Suicidal case in nearby village	162	81
10.	Death occur in family before the incidence	06	03
11.	Suicide in Family	06	03
12.	Serious illness	16	08
13.	Behavioural changes	119	59.5
14.	Addiction	96	48
15.	Social Isolation	186	93
16.	Crop failures	147	73.5

Source: Field Survey

Mounting of stress on account of the accumulation of economic burden caused by repeated crop failures, negative income from agriculture, pending of over dues of bank credit, co-operatives and moneylenders, etc. have been found to be leading to the socio-psychological tensions and the tragic end of life by farmers in the state of Maharashtra. On the whole it may be said that the farm indebtedness on account of the reasons accruing to agricultural vagaries and the lack of infrastructural investment on the part of the government ever since 1985-86 and the absence of institutional extension facilities have been instrumental in negative returns from agriculture of the regions and thereby the crisis and farmers succumbing to the way of tragic end of their life. The study confirms the main reason, i.e. farm indebtedness brought out by earlier studies by the Government of India and independent research attempts with the incidence of the same of the order of 89 per cent for the regions and households under study. 73.50 per cent of the farmers have faced a frequent crop failures resulting into the gap between income and expenditure of the order of 75.50 per cent thereby causing mounting of stress and behavioural changes in the case of 59.50 per cent of the farmers (usually the heads of the family) who ended their lives through suicide.

### Number of Risk Factors Identified in One Suicide Case

No. of HH.	Social status	Economic crisis	Marriage	Indebtedness	*H/W discord	Family Discord with	Disputes with other	Suicide in near place	Suicide in family	Serious illness	Behavioural changes	Addiction	Social isolation	Crop failure	No. of Risk factors
02										√			√		02
08				√		√				√					03
06	√				√				√	√					04

32	√		√	√							√	√		05
39	√	√		√				√				√	√	06
18		√		√				√		√		√	√	06
36		√		√				√		√	√	√	√	07
29		√	√	√				√		√	√	√	√	08
21		√	√	√		√		√		√		√	√	09
09		√		√	√	√	√	√		√	√	√	√	10

Source: Field Survey, \* Husband/Wife Discord

**Suicide is an individual act and also the outcome of the multiple socio-economic and psychological factors. Hence, through the study, one can just throw some light on the factors that lead to distress and thereby towards suicide. It is difficult to find the exact reason of the suicide due to the multidimensionality of the act. The factors that are responsible for distress can be categorized as social, economic, cultural and psychological. We found the multiple reasoning of suicides by farmers. In the earlier analysis we mentioned the factors responsible for the distress act of suicide and here the number of risk factors identified in each suicide case. It is minimum two and maximum of ten. Average six risk factors are identified in each case of suicide which proves that the act of suicide is a multidimensional. It also proves the fundamental theory of suicide; that suicide is an outcome of complex and multiple factors. There are about six factors responsible for taking of lives of 19.5 per cent of the farmers through suicide followed by eight risk factors in case of 14.5 per cent. Nine risk factors are identified in 10.5 per cent of the farm families/farmers.**

### **Conclusion**

**The foregoing analysis brings out the fact that the suicides by farmers in the state is not an outcome of poverty of farmers but the punctured socio-economic pride which made practicing agriculture difficult pushed them in to a debt trap and thereby suicidal behaviour. The migration of rural to urban creates the pressure on the civil services and increase in the incidence of poverty in urban area. The gap between urban and rural income has been widened during the economic reforms period. The incidence of rural poverty is still high at alarming rate which is the matter of concern. The central and state government has taken several steps (Economic Relief Packages- PM and CM) to reduce the farmers suicides and boost the agrarian economy. But all those steps were short term impact. After 2012 onwards again the rate of farmers suicides in the state has been increased. Initially, the spread was limited to Vidarbha but in last three years it widely spread in Marathwada with much faster rate. The government announced policy or delightful schemes for the farmers without understanding the ground reality. On the one hand economy is growing at the faster rate and on the other the rate of unemployment and poverty has been increased. Can economy achieve the inclusive growth in this dualism? Certainly not. In order to reverse the emerging dualism, it is not merely enough to draft an inclusive policy by having a number of supplementary programmes and scheme. It is necessary to restoration of the original agenda of economic development of which inclusion is an integral part. The focus should be on planned development of agriculture and related activities and establishment of micro and cottage industry to generate off farm employment opportunities in rural part. Which will reduces the dependency on agriculture sector for the livelihood purpose. It will also help to reduce the incidence of ‘Disguised**

**Unemployment’ in farm sector and thereby increasing agriculture productivity. The cropping pattern should be eco friendly. ‘Zero Budget Natural Farming’ will help to reduce the cost of cultivation and the quality of the produce. The organic produce gets the good price in the market. And the most importantly the reforms in the input output market mechanism. The issue of Marketed Surplus is the matter of concern and should be focused. The new model like ‘Agriculture Produce Bank’ will give the fare and remunerative price to the farm produce. The farm practices with the rational combination of tradition and new technology will help to release the economic and psychological stress on the farmers. Also, the shift on the policy front for creation of quality rural infrastructure is required. Role of agricultural universities and *Krishi Vigyan Kendras* (KVKs) is vital to revitalize agrarian conditions to some extent. Creation of quality rural infrastructure and provision of credit can improve the resource use efficiency. Hence, unless the plan incorporates the rural and farming economy with the policy intervention on the one front and special targeting of agriculture on the other it will not be possible to achieve the objective of inclusive growth in years to come.**

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# **Institutional Credit Apathy, Indebtedness and Farmers Suicides in India**

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## **Abstract**

The importance of farm credit as a critical input to agriculture is reinforced by the unique role of Indian agriculture in the macroeconomic framework and its role in poverty alleviation. Recognizing the importance of agriculture sector in the development process, the government and the RBI have played a vital role in creating a broad-based institutional framework for catering to the increasing credit requirements of the sector. Agricultural policies in India have been reviewed from time to time to maintain pace with the changing requirements of the agriculture sector, which forms an important segment of the priority sector lending of scheduled commercial banks (SCBs) and target of 18 per cent of net bank credit has been stipulated for the sector. The approach paper of the Eleventh Five Year Plan has set a target of the growth of 4 per cent for the agriculture sector within the overall GDP growth target of 9 per cent. In this context, the need for affordable, sufficient and timely supply of the institutional credit to agriculture has assumed critical importance. But the institutional credit sector in general and co-operative in particular has failed to address their target group. As a result farmers were resorted at the door step of private sources to fulfill their credit need. And the high rates of interest charged by the private moneylenders pushed farmers into the deep valley of economic crisis and thereby distress act of suicides. The present paper will focus and discuss the issue of institutional credit and its impact on the farm economy of India during the post reforms period.

**Key Words:-** Institutional Credit, Agrarian Crisis, Farmers Suicides

## **I. Introduction**

The evolution of the institutional credit to agriculture could be broadly classified into four distinct phases i.e. 1904-1969 the predominance of co-operatives and setting up of RBI, 1969-1975 nationalization of commercial banks and setting up of Regional Rural Banks (RRBs), 1975-1990 setting up of NABARD and from 1991 onwards the period of financial sector reforms. The RBI is perhaps the first central bank in the world to have taken interest in the matters related to agriculture and agricultural credit, and it continuously doing (Ramesh Golait-2007).

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The demand for agricultural credit arises due to; i) the lack of simultaneity between the realization of income and act of expenditure, ii) lumpiness of investment in fixed capital formation and iii) increase in capital investment in agriculture due to technological innovations and liberalized market. Policy makers in India have long recognized the need to provide short and long term institutional credit to agriculture at reasonable rates for meeting farmers needs. This was in recognition primarily as the moneylenders and other non-institutional sources charged higher rates of interest to farmers who often had to mortgage, and sometimes, sell their lands to clear their debt.

## II. Conceptual Framework

Commercialization of agriculture coupled with increasing requirement of credit have put a lot of onus on various agricultural financial institutions to play pivotal role in meeting the increasing capital needs of the farmers and ensuring timely supply of various besides providing other service facilities. The diversification of agriculture over the years has further accentuated the need for the rapid development of rural infrastructure the larger flow of credit to farming community. In the agriculture set up, borrowing is a necessary. It is neither objectionable nor is the sign of weakness. It is the failure of the institutional set up in supplying credit commensurate with demand that is mainly responsible for the crisis and its manifestation in the form of farmers suicides (Gill & Singh-2006). The causes of the farmers suicides, of which indebtedness figured prominently, were multiple. The cooperative sector is specially meant for the fulfillment of the credit need of agriculture sector and especially small and marginal farmers. During the pre financial liberalisation period these institutions were performing well and the share of cooperative lending in total agriculture lending was 69.5 per cent in 1975-76 which was declined substantially at the level of 21.8 per cent in 2005-06 (Ministry of Finance-2007). As a result the share of non-institutional sources in agriculture credit disbursement has been increased. There is a positive correlation between non-institutional credit, indebtedness and farmers suicides in India (P. Sathish-2006). The cooperative institutions are failed to address their targeted section and causes for the agrarian crisis in India. It is also pointed out in several studies; Deshpande (2002, 2008), M Assadi (2006), IGIDR (2007), Planning Commission (2006), Srijit Misra (2006), Shah (2005), Rao and Suri (2006) etc.

## III. The Debate

The sharp decline in institutional lending for the sector and thereby ignited the crisis as availing of credit from private moneylenders became costlier as a result during nineties the country witnessed increasing number of suicides. The bankers' perceptions about risk involvement in agriculture lending might have forced them to adopt credit rationing for agriculture and thereby progressive decline in the credit performance indices at the national level.

**Table-01 Source Wise Institutional Credit Flow to Agriculture- 1975-76 to 2005-06 (Rs. in Crore)**

Agency	1975-	1983-	1993-	2001-	2002-	2003-	2004-	2005-
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	76	84	94	02	03	04	05	06
<b>Short Term</b>	1177	3335	11271	40509	45586	54977	74064	105350
Cooperatives	881	2158	7839	18787	19668	22640	27157	34930
Regional Rural Bank	2	120	732	3777	4775	6088	10010	12712
Commercial Bank	213	872	2700	17904	21104	26192	36793	57640
Other agencies	82	185	00	41	39	57	104	68
<b>Medium and Long Term</b>	498	1909	5223	21536	23974	32004	51245	75136
Cooperatives	305	780	2278	4737	3968	4235	4074	4474
Regional Rural Bank	2	143	245	1077	1295	1493	2394	2511
Commercial Bank	192	986	2700	15683	18670	26249	44688	67837
Other agencies	--	--	00	39	41	27	89	314
<b>Total Credit</b>	1675	5244	16494	62045	69560	86981	125309	180486
Cooperatives	1186	2938	10117	23524	23636	26875	31231	39404
Regional Rural Bank	2	263	977	4854	6070	7581	12404	15223
Commercial Bank	405	1885	5400	33587	39774	52441	81481	125477
Other agencies	82	185	00	80	80	84	193	382

Source: RBI and NABARD report-2006

Institutional credit expanded rapidly during the post bank nationalization period from Rs.1,675 crore in 1975-76 to Rs.1,80,486 crore in 2005-06. The rate of the growth was even higher than the growth rates of GDP originating in agriculture. Despite this growth, the credit needs of agriculture have not been met fully and overwhelming number of farm households have not been able to borrow from institutional sources. Which has increased borrowing of the farmers from the private sources at high rates of interest. While short term credit has remained the dominant component of total credit. Its relative importance declined from 70.3 per cent in 1975-76 to 58.1 per cent in 2005-06. Declined returns from agriculture sector caused for the debt accumulation of farmers.

**Table-02 Direct Short Term and Long Term Loans for Agriculture and Allied Activities by Formal Institutions (Rs. Crore)**

Year	Co-operatives	% change	State Governments	SCBs	% change	RRB	Total	% change
1971-72	769	--	99	15	--	--	883	--
1972-73	958	19.72	177	21	28.57	--	1156	23.61
1973-74	877	-9.23	91	219	90.41	--	1187	2.61

1974-75	1039	15.59	78	274	20.07	--	1391	14.66
1975-76	1187	12.46	82	405	32.34	2	1675	16.95
1976-77	1431	17.05	82	508	20.27	16	2037	17.77
1977-78	1444	0.90	98	569	10.72	44	2155	5.47
1978-79	1621	10.91	119	800	28.87	101	2641	18.40
1979-80	1821	10.98	133	975	17.94	--	2928	9.80
1980-81	2029	10.25	144	1263	22.80	--	3436	14.78
1981-82	2479	18.15	153	1496	15.57	168	4296	20.01
1982-83	2717	8.75	188	1225	-22.12	222	4352	1.28
1983-84	2938	7.52	185	1858	34.06	263	5244	17.00
1984-85	3154	6.84	241	2461	24.50	310	6167	14.96
1985-86	3674	14.15	354	2729	9.82	402	7159	13.85
1986-87	3701	0.72	210	3332	18.09	477	7720	7.26
1987-88	4710	21.42	478	3526	5.50	483	9198	16.06
1988-89	4873	3.34	275	3813	7.52	420	9381	1.95
1989-90	5407	9.87	292	4282	10.95	647	19628	52.20
1990-91	4819	-12.20	359	4676	8.42	335	10188	-92.65
1991-92	5797	16.87	339	4806	2.70	569	11538	11.70
1992-93	6484	10.59	389	4960	3.10	698	12530	7.91
1993-94	8484	23.57	377	5400	8.14	752	15013	16.53
1994-95	9876	14.09	407	7408	27.10	1083	18773	20.02
1995-96	12483	20.88	554	9274	20.12	1381	23692	20.76
1996-97	13254	5.81	668	10675	13.12	1748	26345	10.07
1997-98	14159	6.39	858	11537	7.47	2103	28656	8.06
1998-99	15099	6.22	420	14663	21.31	2515	32697	12.35
1999-00	25678	41.19	520	16350	10.31	2985	45534	28.19
2000-01	27295	5.92	487	16440	0.54	3966	48187	5.50
2001-02	30569	10.71	443	18638	11.79	4546	54195	11.08
2002-03	34040	10.19	--	25256	26.20	5879	65175	16.84
2003-04	40049	15.00	--	36203	30.23	7175	83427	21.87
2004-05	45009	11.02	--	48367	25.14	11927	105303	20.77
2005-06	48123	6.47	--	80599	39.99	15300	144021	26.88
2006-07	54019	10.91	--	115266	30.07	20228	189513	24.00
2007-08	57643	6.28	--	113472	-1.58	23838	194953	2.79
2008-09	58787	1.94	--	--	--	26499	85286	-128.58

Source: RBI Hand Book 2010

\* Except SCBs and Government SCBs- Scheduled Commercial Banks, RRBs- Regional Rural Bank

**High rates of interest, crop failure, negative returns, extent and incidence of indebtedness and low credit ability on the one hand and the neglect of agriculture by the formal sector of lending on the other had increased dependency of farmers on private sources of credit for more than 80 per cent during post reforms period. The ensuing agrarian distress on account of declining monetary support by-way of public investment and neglect of the sector by institutional lending mechanism was first predicted in 1986 (Rath).**

**Looking at the short and long term advances for agriculture and allied sectors by formal institutions between 1970-71 and 2008-09, it comes out that the neglect of sector has continuously increased and thereby the distress and strengthening of the grip of private moneylenders. Cultivation being the main source of farm household income and if that itself is not supported by the institutional lending mechanism leads to the increase in cultivation expenditure as farmers to pay higher rates of interest to private moneylenders. Number of banks both in public and private sector achieving the statutory target of 18 per cent between March 2001 and March 2003 has not been more than six (Public Sector) and two (Private Sector) respectively (Deshpande-2008).**

**Table-03 Share of Co-operatives in Total Agriculture Credit in India 1975-76 to 2005-06 (in per cent)**

Type of Loan	1975-76	1983-84	1993-94	2001-02	2002-03	2003-04	2004-05	2005-06
Crop Loan	74.9	64.7	69.6	46.4	43.1	41.2	36.7	33.2
Term Loan	61.2	40.9	43.6	22.0	16.6	13.2	8.0	6.0
All Loans	70.8	56.0	61.3	37.9	34.0	30.9	24.9	21.8

Source: NABARD-2006

**Issues relating to agricultural credit include the poor performance of credit co-operatives and Regional Rural Banks and on the other hand inability of commercial banks to meet their targets for agricultural lending and high cost of rural banking. The result has been the continued dependence of farmers on non-institutional sources and the inability of small farmers to obtain timely and adequate institutional credit. Historically, co-operatives have played a vital role in the provision of institutional credit to agriculture sector. With the entry of commercial banks in rural areas, the share of co-operative credit in total agricultural credit had gone down. It fell from 69.5 per cent in 1975-76 to only 21.8 per cent in 2005-06. Also the share in crop loan has declined from 74.9 per cent in 1975-76 to 33.2 per cent in 2005-06. It means the co-operative sector was not fulfilling the commitments. And also their functioning is regulated by politically dominant groups. These institutions have become a way to entry in politics hence they resort to 'Favouritism Principle' for credit disbursement rather than the need based disbursement. While the share of co-operatives in Term Loan declined from 61.2 per cent (1975-76) to 6.0 per cent in 2005-06. At the same time commercial banks have become dominant source of credit to the agriculture sector.**



**Table-04 State-wise Estimated Number of Rural Households, Total and Indebted Farm Households**

States	Estimated Number of Rural Households (00)	Estimated Number of Farmer Households (00)	Estimated Number of Indebted Farmer Households (00)	% of Farmer Households Indebted
Andhra Pradesh	142512	60339	49493	82.0
Arunachal P.	15412	1227	72	5.9
Assam	41525	25040	4536	18.1
Bihar	116853	70804	23383	33.0
Chhatisgarh	36316	27598	11092	40.2
Gujarat	63015	37845	19644	51.9
Haryana	31474	19445	10330	53.1
Himachal P.	11928	9061	3030	33.4
Jammu & K.	10418	9432	3003	31.8
Jharkhand	36930	28338	5893	20.9
Karnataka	69908	40413	24897	61.6
Kerala	49942	21946	14126	64.4
Madhya P.	93398	63206	32110	50.8
Maharashtra	118177	65817	36098	54.8
Manipur	2685	2146	533	24.8
Meghalaya	3401	2543	103	4.1
Mizoram	942	780	184	23.6
Ngaland	973	805	294	36.5
Orissa	66199	42341	20250	47.8
Punjab	29847	18442	12069	65.4
Rajasthan	70172	53080	27828	52.4
Sikkim	812	531	174	38.8
Tamil Nadu	110182	38880	28954	74.5
Tripura	5977	2333	1148	49.2
Uttar Pradesh	221499	171575	69199	40.3
Uttaranchal	11959	8962	644	7.2
West Bengal	121667	69226	34696	50.1
UTs	2325	732	372	50.8
All India	1478988	893504	434242	48.6

Source: Agricultural Statistics at a Glance, 2005, Directorate of Economics and Statistics, MoA, GoI

Indebtedness of farmers is basically due to the unsatisfactory performance of organized sector lending. Looking at the credit deposit ratio and the ratio of agriculture lending to total credit of banking sector, it comes out that the availability of bank credit for agriculture has been far less than the demand for over a long period of time. Data in the

above table brings out a state-wise number and percentage of indebted farm households where the states of Andhra Pradesh, Tamil Nadu, Punjab, Kerala, Karnataka and Maharashtra are more affected than rest of the states with corresponding percentage of 82, 74.5, 65.4, 64.4, 61.6 and 52.8 respectively. This picture underlines the finding that majority of suicide affected families were debt ridden families.

**Table-05 Indebtedness of Farm Households in Different Size Classes of Land Holdings**

Holding Size (Ha.)	Estimated Number of Farm Households (Lakh)	%to Total in Each Class	Estimated Number of Indebted FHHs (Lakh)	% to Total in Each Class	% of Indebted FHHs to Total	Average Outstanding Loan Amount (Rs.)
Up to 0.01	12.59	1.4	5.71	1.3	45.3	6121
0.01-0.40	292.87	32.8	130.11	30.0	44.4	6545
0.41-1.00	183.61	31.7	129.21	29.8	45.6	8623
1.01-2.00	160.60	18.0	81.92	18.8	51.0	13762
2.01-4.00	93.50	10.5	54.41	12.5	58.2	23456
4.01-10.00	42.58	4.8	27.73	6.4	65.1	42532
More 10 ha.	7.75	0.8	5.15	1.2	66.4	76232
All Classes	893.50	100.0	434.24	100.0	48.6	12585

Source: Agricultural Statistics at a Glance, 2005, Directorate of Economics and Statistics, MoA, GoI

FHHs=Farm Households

The share of farm households with less than one ha. of land holding in total farm households comes out to be 65.9 per cent and also substantial number of estimated number of indebted farm households comes out from the same category with average loan outstanding to be more than Rs.6000. Data shows holding-wise outstanding debt per account for different categories of states for over a period of more than fifteen years covering pre and early post reforms period brings out that except few states (Punjab, Orissa, West Bengal and Kerala) and for an occasional time period all other states have shown a fast increasing trend in the average outstanding debt per account. This kind of a situation takes out farmers credit ability in future as their loan accounts enter the category of bad accounts. Information about per hectare outstanding of credit for over a period of ten years covering the period 1980-81 to 1990-91 brings out that in case of almost all states (except Rajasthan) the amount of per hectare outstanding of loan has increased sharply. In case of some states per hectare outstanding is more than per hectare availability of loan amount.

**Table-06 Income, Expenditure and Indebtedness of Farmer Households: July 2002-June 2003**

State	Annual cultivation income	Annual total income	Annual cultivation expenditure	Annual total expenditure	(2) – (4)	(3) – (5)
1	2	3	4	5	6	7
Andhra P.	8916	19608	12085	28632	-3169	-9024
Assam	21504	37932	3370	32568	18134	5364
Bihar	10152	21720	6809	29508	3343	-7788
Gujarat	13968	32208	11456	37524	2512	-5316
Haryana	17928	34584	18270	52963	-342	-18384
J & K	29112	65856	6342	49308	22770	16548
Karnataka	15192	31392	10344	31296	4848	96
Kerala	13440	48048	7793	51000	5647	-2952
M. P.	11952	17160	8886	28068	3066	-10908
Maharashtra	15156	29556	10793	32268	4363	-2712
Orissa	4032	12744	3143	20364	886	-7620
Punjab	33864	59520	25945	58080	7919	1440
Rajasthan	4308	17976	7668	39456	-3360	-21480
Tamil Nadu	7908	24864	8597	30072	-689	-5208
U. P.	10032	19596	9151	34788	881	-15192
West Bengal	8844	24948	8429	32016	415	-7068
All-India	11628	25380	8791	33240	2837	-7860

Source: NSSO (2005a & 2005c)

Looking at the prospects of profitability of farmers through comparison between the annual cultivation expenditure and the annual income from cultivation, the prevalence of crisis in rural countryside of India comes out vividly. Deducting the all India household average annual income from cultivation (Rs.11628.00) from the annual household cultivation expenditure (Rs.8791.00) the average household net income remains Rs.2837 which is available for the family consumption and maintenance. In states like Andhra Pradesh, Haryana, Rajasthan and Tamil Nadu the annual average net income is negative. And in states of Orissa, Uttar Pradesh and West Bengal the average annual net income from cultivation is less than Rs.1000 per farm household. When calculated the farm household annual net balance comparing the annual total income and annual consumption expenditure the picture becomes further worst. This clearly supports the observation that something is terrible in rural countryside of India. It means the cost of cultivation rises sharply but the minimum support price mechanism has failed to give remunerative prices to the agriculture produce. Increased gap between income and expenditure forced farmers to borrow from private sources to fulfill this gap. Due to the inadequate institutional credit support farmers resorted to private moneylenders who charged heavy rates of interest. In all, these vagaries accumulate debt and it goes beyond the repaying capacity of farmers.

**Table-07 Incidence of Indebtedness in Major States – 2003**

Sr. No.	States	Number of Indebted Households	of Farm Households (%)	Average Loan per Households (Rs)
1.	Andhra P.	49493	82.0	23965
2.	Tamilnadu	28954	74.5	23963
3.	Punjab	12069	65.4	41576
4.	Kerala	14126	64.4	33907
5.	Karnataka	24897	61.6	18135
6.	Maharashtra	36098	54.8	16973
7.	Haryana	10330	53.1	26007
8.	Rajasthan	27828	52.4	18372
9.	Gujarat	19644	51.9	15526
10.	Madhya P.	32110	50.8	14218
11.	West Bengal	34696	50.1	10931
12.	Orissa	20250	47.8	5871
13.	Uttar Pradesh	69199	40.3	7425
14.	Himachal P.	3030	33.4	9618
15.	Bihar	23383	33.0	4476
16.	Jammu & K.	3003	31.8	1903
17.	Assam	4536	18.1	813
18.	All India	434242	48.6	12585

Source: NSSO Situation Assessment Survey of Farmers, 2005

State wise analysis of indebtedness has shown; the incidence of indebtedness was high in the states where the agriculture is more capital intensive. As well as, these states experienced more success of green revolution as compare to other states i.e. Punjab, Maharashtra, Karnataka, Haryana, Andhra Pradesh, Gujarat and Kerala. Andhra Pradesh has the 82 per cent of indebted farm households followed by Tamilnadu with 74.5 per cent. But, Tamilnadu has less number of farm suicides despite incidence of indebtedness. The average outstanding debt of per farm household was high in Punjab followed by Kerala. Because of the characteristics of the agriculture of these states is highly capital intensive as compare to other states. On the other hand, the incidence of indebtedness and outstanding debt per farm household was low in the states from central, eastern and north eastern states. Where, agriculture is the way of livelihood and not a commercial one. And these states are mostly producing food-grains than cash crops. In all, the incidence and outstanding debt was high in the states that shifted their agriculture from food-grains to commercial crops, which needs high techniques as well as investment. But, the present agricultural marketing did not give adequate returns to the farmers. As a result, the gap between income and expenditure has widened and farmers were forced to borrow money to fulfilling the gap.

Hence, the incidence of indebtedness and outstanding has been growing beyond the repaying capacity of farmer.

**Table-08 Share of Debt of Cultivator Households from Different Sources – 1951-2002 (%)**

Source of credit	1951	1961	%	1971	%	1981	%	1991	%	2002	%
Institutional	7.3	18.7	156.16	31.7	69.51	63.2	99.36	66.3	4.90	61.1	-7.84
Cooperatives	3.3	2.6	-21.21	22.0	746.15	29.8	35.45	30.0	0.67	30.2	0.66
Commercial Banks	0.9	0.6	-33.33	2.4	300	28.8	1100	35.2	22.22	26.3	-25.28
Non Institutional	92.7	81.3	-12.29	66.3	-18.45	36.8	-44.49	30.6	-16.84	38.9	27.12
Moneylender	69.7	49.2	-29.41	36.1	-26.62	16.1	-55.40	17.5	8.69	26.8	53.14
Unspecified	23.0	32.1	40.03	30.2	-5.91	20.7	-31.45	13.1	-36.71	12.1	-0.76

Source: Report of the Expert Group on Agriculture Indebtedness, 2007

%- Percentage Change

The share of institutional sources in cultivators' debt improved considerably after the nationalization of banks, from 32 per cent in 1972 to 66 per cent in 1991. But, during the 1990s the period of financial liberalization, there was a loss of momentum of agriculture lending and share declined and resorted at 61 per cent in 2002. The share of commercial banks has increased during the pre reforms period. After the introduction of new economic policy, commercial banks reduced credit flow to agriculture from 35.2 per cent to 26.3 per cent. Because, agricultural lending was no more profit making business. As well as, supply of credit from co-operatives was mere stagnant. As a result the dependency of farmers on moneylenders increased substantially. Basically, co-operatives were meant for fulfilling the credit needs of small and marginal farmers. As the time passed, co-operatives were far away from their goal and pushed farmers into the trap of private money lending. The share of co-operatives in total agricultural lending was 30.2 per cent in 2002 with increase of 0.66 per cent over 1991. The lending from co-operatives never crossed 30 per cent during throughout the period means 70 per cent share was taken by the commercial banks and private money lending. Every year the government budget target announces the increment in the agriculture lending but it is only a book adjustment and not in real terms. Hence, again private credit sources become an important and sustainable source of credit to farming community and it becomes the matter of concern.

**Table-09 Distribution of Debt by Sources across Major States – 2003 (%)**

States	Institutional				Non Institutional			
	Govt.	Co-op	Banks	Total	Money lenders	Trades	Others	Total
Maharashtra	1.2	48.5	34.1	83.8	6.8	0.8	8.6	16.2
Kerala	4.9	28.3	49.1	82.3	7.4	1.7	8.5	17.6

Uttaranchal	31.5	4.8	39.8	76.1	5.9	1.7	16.3	23.9
Orissa	13.0	18.1	43.7	74.8	14.8	0.8	9.5	25.1
Chhatisgarh	1.3	20.6	50.5	72.4	13.0	4.2	10.5	27.7
Gujarat	0.5	41.8	27.2	69.5	6.5	4.4	19.6	30.5
Karnataka	1.9	16.9	50.1	68.9	20.0	1.9	9.3	31.2
Haryana	1.1	23.9	42.6	67.6	24.1	3.1	5.3	32.5
J & K	13.1	0.2	54.3	67.6	1.1	15.5	15.7	32.3
Himachal P.	6.1	11.6	47.6	65.3	7.2	5.5	22.0	34.7
Jharkhand	3.9	4.5	55.7	64.1	19.0	1.7	15.2	35.9
Uttar P.	2.4	6.7	51.2	60.3	19.1	2.9	17.7	39.7
West Bengal	10.3	19.2	28.5	58.6	13.0	10.7	18.4	42.1
Madhya P.	1.9	16.9	38.1	56.4	22.6	9.0	11.4	43.0
Tamil Nadu	2.0	23.3	28.1	53.4	39.7	0.4	6.4	46.5
Punjab	1.9	17.6	28.4	47.9	36.3	8.2	7.6	52.1
Bihar	2.2	2.5	37.0	41.7	32.8	1.1	24.6	58.5
Assam	7.0	2.7	27.8	37.5	15.5	12.0	35.1	62.6
Rajsthan	1.3	5.9	27.0	34.2	36.5	19.2	10.1	65.8
Andhra P.	1.0	10.4	20.0	31.4	53.4	4.8	10.4	68.6
All India	2.5	19.6	35.6	57.7	25.7	5.2	11.5	42.4

Source: NSSO Situation Assessment Survey of Farmers, 2005

Co-operative credit societies were basically meant for the supply of credit to the agriculture in general and that small and marginal in particular. But, in fact this target is fulfilled only in the five states i.e. Maharashtra, Gujarat, Kerala, Haryana and Tamilnadu. The share of co-operatives in farmers suicides affected states was very low i.e. Karnataka- 16.9, Andhra Pradesh- 10.4 and in Punjab – 17.6 per cent. Only Maharashtra among the suicides affected states has 48.5 per cent share of co-operatives in agricultural lending. The efficient mechanism traced out in Western Maharashtra region where the co-operative movement is deeply rooted and other regions of the state have not been that much successful in co-operative lending. And only big and politically influenced farmers are the beneficiaries of the co-operative credit whereas small and marginal farmers did not receive expected returns from it. As well as, the share of Banks in total agricultural lending was not remarkable. The share of non institutional lending was high in Andhra Pradesh with 68.5 per cent, higher than of national average of 42.4 per cent. Looking at the national scenario of non-institutional sources still 42.4 per cent farmers depend on private sources on record and off the record figure can be more. Means 42.4 per cent of farmers were out of the reach of institutional credit mechanism. And in recent survey of the NSSO (2005) 41 per cent of farmers are willing to leave the agriculture if they have other opportunity of employment available.



**Table-10 Distribution of Debt by Purpose among Rural Cultivator Households-1961-2002**

Purpose	1961	1971	1981	2002
Productive	40.1	54.0	71.6	62.9
Farm business	36.6	49.7	63.8	52.5
Capital expenditure	26.8	34.7	45.3	34.3
Current expenditure	9.8	15.0	18.5	18.2
Non-farm Business	3.5	4.3	7.8	9.4
Capital expenditure	1.4	3.2	6.3	7.4
Current expenditure	2.1	1.1	1.5	2.0
Non-productive	60.0	46.0	28.4	38.1
Household expenditure	49.2	37.8	20.0	27.7
Other Purposes	10.8	7.2	8.4	10.4
Repayment of Debt	5.0	1.5	0.1	1.5
Expenditure on Litigation	1.8	0.7	0.8	0.3
Financial Investment	0.2	0.2	1.0	0.6

Source: RBI, All India Rural Debt and Investment Survey, 1961-62, 1971-72, 1981-82 and 2003, NSSO-2005

A substantial proportion of cultivator households' debt was for productive purposes at all India level. However, debt for productive purposes as a per cent of total debt declined from 72 per cent in 1981 to 63 per cent in 2002. Similarly the share of debt incurred for farm business declined from 64 per cent in 1981 to 53 per cent in 2002. Within farm business expenditure, the share of capital expenditure declined from 45.3 per cent to 34.3 per cent. The increase in capital expenditure for non-farm business could not fully compensate the fall in farm business expenditure, which resulted in a fall in the share of overall productive expenditure between 1981 and 2002.

#### **IV. Farmers Suicides Scenario in India**

The foregoing discussion on policy of institutional credit matters revealed that the agriculture and farming community of the country has at the marginal. Looking at the overall nature and performance of the policies (1951-2010) towards agriculture, that have failed to address the agriculture. Despite institutional reforms in agricultural credit and marketing, the state of the agriculture remains unremmunarative. Some hopes were created by the Green Revolution during the mid sixties. But, afterwards it showed the negative side of the same. The green revolution did not succeed due to the lack of inclusiveness. It concentrated only on few crops and states in the country. The situation further aggravated during the post reforms period in general and post WTO amendment in particular. Both the things i.e. economic reforms and WTO have long term negative impact on agriculture and farming community of the country.

The large number of suicides by farmers in various states of the country has been the outcome of the negligence of the agriculture on policy front since independence. The incidences of farmers suicides became epidemic in some states of the country. The incidence

of farm suicides started in 1986 and continuously increased during the subsequent decades of the 1990s and 2000s.

**Table-11 Number of Farmers Suicides and Total Suicides in India-1997-2006**

Year	Farmers Suicides		All Suicides	
	No. of Farm Suicides	As (%) to All Suicides	All Suicides	Suicide Rate (per 1 lakh Population)
1997	13622 (100)	14.2	95829 (100)	10.0
1998	16015 (118)	15.3	104713 (109)	10.8
1999	16082 (111)	14.5	110587 (115)	11.2
2000	16603 (122)	15.3	108593 (113)	10.6
2001	16415 (121)	15.1	108506 (113)	10.6
2002	17971 (132)	16.3	110417 (115)	10.5
2003	17164 (126)	15.5	110851 (116)	10.4
2004	18241 (134)	16.0	113697 (119)	10.5
2005	17131 (126)	15.0	113914 (119)	10.3
2006	17060 (125)	14.4	118112 (123)	10.5
<b>Total</b>	<b>166304</b>	<b>15.2</b>	<b>1095219</b>	<b>--</b>

Source: K Nagraj, 2008

Figures in parentheses indicate indices with 1997 as the base year

During the ten year period between 1997 and 2006 as many as 166304 farmers ended their lives through committing suicide. And this is not a good sign for a country where 58.5 per cent of the labour force still depends on agriculture for their livelihood and the sector which is the backbone of the economy. If we consider the 12 years period from 1995 to 2006 then the figure of 200000 (190735) would be an underestimation since a couple of major states like Tamil Nadu and Rajasthan and a number of smaller states like Pondicherry did not report any farm suicides for one or the other or both of these two years. During the field visits for the present study we observed that the police often adopted a rather strict and stringent definition of a farmer in identifying farm suicides. The title to land was taken as the criterion for identifying farmer and this often left out many genuine farmers from the count. For example, a tenant farmer who leased in land and hence did not have a title to the land could be denied the status of a farmer. The same happened when the title of the

undivided land which was in the name of the head of the family. From the data in the table (No. 12), that the number of farm suicides has kept steadily increasing over this period in the country. The year 1998 in fact shows a sharp increase in the number of farm suicides with 18 per cent jump from the previous year and the number remained more or less steady at around 16000 farm suicides per year over the next three years up to 2001. The year 2002 again saw a sharp increase close to 10 per cent as compared to 2001 and the number of farm suicides remained around 18000 per year during the period after that. The average number of farm suicides per year in five year period of 2002-2006 stood at 17,513 which is substantially higher than the average of 15747 for the previous five year period. There are certain regions in the country where the farm suicides are largely concentrated and where the problem has been a very sharp over this period with the farm suicides increasing at much faster rate, in comparison, both with farm suicides in the country and general suicides in these regions.

## **V. Conclusion**

In India the marginalizing of agriculture sector ever since 1980s in the national planning and declined state investment in rural infrastructure and extension had caused an increase in the cost of cultivation at individual farm level which resulted in the manifestation of agriculture crisis that deepened further during the period of economic reforms with a resultant impact in the form of farmers suicides in the country. Hence reporting and continuous increase of the suicidal mortality rate amongst the farming community has become a serious issue of the post reforms period of the world economy in general and that of the India in particular. The foregoing analysis reveals that the suicides of farmers in the state of Maharashtra has neither been an incidence out of poverty amongst farming community nor is the inefficiency of the farmers or an unproductive use of credit money has pushed them into the death trap but it is on account of a punctured pride, caused by the accumulated economic tensions as they continuously faced through unexpected losses for a long time plus negligence of agriculture in national and state policy kind of a thing ever since 1986 at the national level that led to the suicides of many. Use of credit, time, adequacy and price for the same had caused long term impacts on the lives of farmers and the farming economy. The rural institutional credit sector of the regions neither could eliminate nor has been able to control the lending rates and the dominance on lending by private moneylenders. 33.50 per cent of the farmers borrowed from the private moneylenders at a lending rate ranging from 36 to 120 per cent per annum can double the borrowed money in a few months. Nationalised commercial banks advances to agriculture could not cross the limit of 11.5 per cent leaving aside the statutory expectation of 18 per cent needs to give a serious thought. In all, the foregoing analysis of the macroeconomic policies towards agriculture in general and during the post reforms in particular revealed the changed nature of the policies that have the concordant negative impact on Indian agriculture. It also has the positive correlation of significantly higher degree with the farmers suicides in India.

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## **Farmers Suicides Reality in Maharashtra**

**Dr.Kale Sambhaji Bhaurao\***

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### **Introduction :-**

The recent trends in Indian agriculture showing that critical situation of agriculture sector in the country. In recent period several unfavorable things such as suicides of farmers in many advanced states of the country. Declining the production or prices of various crops, more importantly steady decline of agriculture growth rate as well as share of agriculture in GDP. Has made great attention b policy makers, researchers and media. Many studies conducted by individuals and institutions clearly stated that the frustra rated conditions of farmers which driven to take the extreme step of suicide by farmers. It is importantly noted that the suicides are concentrated in a few regions such as Karnataka, Andhra Pradesh, Maharashtra, Kerala, Punjab. Farmer's suicides has been received a lot of social and public policy attention, particularly in advanced states like Andhra Pradesh, Karnataka, Maharashtra, Kerala, Punjab. Many reviews on suicides indicated that the dependence on agriculture is largely among marginal and small farmers and agricultural labour. One of the important reasons of the crisis conditions is that the absence of formal rural financial market led to dependence on informal sources where greater interest rate existed. The decline and uncertainty in earnings from agricultural operations, along with the increasing dependence on purchased inputs and a higher level of barrowing especially form informal sources, consequent difficulties in meeting repayment obligations, which add to the farmers distress.

### **Suicides in Maharashtra :-**

The suicides by farmers in many states have made the problem of indebtedness of farmers a central issue needing urgent attention. It was in this context the government of India constituted an expert group to look into the problems of agricultural indebtedness and to suggest measures to provide relief of the farmers across the country. Suicides are a complex and multifaceted phenomenon.

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**Maharashtra constituted 9.4 percent of the all India Population but accounted for 13.5 percent of the total suicide deaths in the country. Suicide accounted for 2 percent of the total deaths in the state where as at the all India level suicide, accounted for 1.3 percent of total deaths. In 2001 the age adjusted suicide mortality rate for Maharashtra was 20.6 for males and 12.6 females where as for India it was 14.0 for males and 9.5 for females.**

#### **Male and Female Farmer Suicide in Maharashtra**

<b>Year</b>	<b>Male</b>	<b>Female</b>	<b>Total</b>
<b>1995</b>	<b>978</b>	<b>105</b>	<b>1083</b>
<b>1996</b>	<b>1570</b>	<b>411</b>	<b>1981</b>
<b>1997</b>	<b>1600</b>	<b>317</b>	<b>1937</b>
<b>1998</b>	<b>1938</b>	<b>417</b>	<b>2355</b>
<b>1999</b>	<b>2050</b>	<b>317</b>	<b>2367</b>
<b>2000</b>	<b>2492</b>	<b>530</b>	<b>3022</b>
<b>2001</b>	<b>2945</b>	<b>591</b>	<b>3536</b>
<b>2002</b>	<b>3155</b>	<b>540</b>	<b>3695</b>
<b>2003</b>	<b>3381</b>	<b>455</b>	<b>3836</b>
<b>2004</b>	<b>3799</b>	<b>348</b>	<b>4147</b>

#### **Causes/Reason For Farmers Suicide**

- 1) Heavy Loans over heads.**
- 2) Unsuccessful Cotton Crop**
- 3) Low rate of Agriculture Production**



- 4) Lack of Information, illiterate, lack of agriculture training**
- 5) Decreasing Investment in Agriculture In Indian Union and State Budget**
- 6) Negative and useful policy about transport**
- 7) Gross rate and agriculture product rate are wrong**
- 8) Environment Change and its Effect on Agriculture Product**
- 9) Non co-operation of Government**
- 10) Life Style**
- 11) Agriculture Insurance System**
- 12) Traditional Poverty**
- 13) Substitute Income Problems**
- 14) Agriculture Subsidy Problems**
- 15) Agriculture loans use in wrong**
- 16) Electricity Load Shading and Farmers Risk**
- 17) Scarcity of Irrigation Schemes**
- 18) Multinational Companies Policy**
- 19) Live Stock**
- 20) Natural Cycle**
- 21) Economics of income and expenditure**
- 22) Low size of land holding**
- 23) lack of joint family system**
- 24) Illness**
- 25) Crop Insurance**
- 26) Drought**
- 27) Addictions**

- 28) Low productivity of Agriculture**
- 29) Economic policy of Agriculture**
- 30) Govt. providing low funding for agriculture development**
- 31) Globalization of Agriculture**
- 32) Lack of irrigation facility**
- 33) Lack of secondary occupation**
- 34) Indebtedness**
- 35) Low income**
- 36) Social & custom**
- 37) Family disputes**
- 38) Adverse effect on social Status**
- 39) Health related problem**
- 40) Increase price of agriculture inputs**

**Remedies for suicides of farmers in Maharashtra :-**

- **Enhance the physical Interaction between govt. functionaries and village society by insisting on more tours, night halts and gram sabha by officers at all levels of the administration.**
- **Actively monitor local society, especially farmers, for signs of social, economic and psychological distress and if possible provide social, psychological or spiritual counseling.**
- **Implement with rigor the various provisions that already exist to safeguard the interest for the farmer and farm workers for example, the existing money lending act, minimum wage act. etc.**
- **Increase the efficiency of agriculture extension activates**
- **Increase the efficiency of various services that are delivered by the govt. in the name of people's welfare at the moment.**

- **Make available trained and salaried individuals to serve the rural population.**
- **For the long term change, it is important to improve the of school education and provide appropriate vocational education at the village and taluka level so as to make people understand the complexities of present day production and Marketing techniques.**
- **Counsel the media to stop highlighting suicides since the fact of highlighting suicides itself adds fuel to the suicides fire as it were.**
- **Instead of ex gratia payment being made to families of those who commits suicides, provides employment to a member of the family or help in setting up small business.**
- **Provide direct cash subsidies to actual cultivators.**

#### **Conclusion :-**

**There is no doubt that agriculture has suffered due to long neglect and inadequate allocation of resources. Inclusive growth would require a major shift in our planning strategies and a much higher allocation of development and plan resources. So that there is an urgent need for us to look at the critical situation in agriculture sector by taking an action plan. Strengthen of agriculture will help in up lifement of the farmers and also benefit the larger section of the rural poor who are directly engaged in agriculture or indirectly linked with agriculture as consumers. The growth of the country highly affected by the performance this primary sector. So that to achieve the target growth rate in GDP as well achievement of inclusive growth in India is possible only when there is significant growth in agriculture.**

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## **Causes & Responses to Farmers Suicides in India**

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### **I) Introduction :-**

Historical records relating to frustration, revolts and high mortality rates among farmers in India, particularly cash crop farmers, date back to the 19<sup>th</sup> century. However, suicides due to the same were rare. The high land taxes of 1870, payable in cash regardless of the effects of frequent famines on farm output or productivity, combined with colonial protection of usuary, money lenders and landowner rights, contributed to widespread penury and frustration among cotton and other farmers, ultimately leading to the Deccan Riots of 1875-1877. The British government enacted the Deccan Agriculturists Relief Act in 1879, to limit the interest rate charged by money lenders to Deccan cotton farmers, but applied it selectively to areas that served British cotton trading interests. Rural mortality rates, in predominantly agrarian British India, were very high between 1850 and the 1940. However, starvation related deaths far exceeded those by suicide, the latter being officially classified under “injuries”. The death rate classified under “injuries”, in 1897, was 79 per 100, in Central Provinces of India and 37 per 100,000 people in Bombay Presidency.

Ganapathi and Venkoba Rao analyzed suicides in parts of Tamil Nadu in 1966. They recommended that the distribution of agricultural organo-phosphorus compounds be restricted. Similarly, Nandi et al. in 1979 noted the role of freely available agricultural insecticides in suicides in rural West Bengal and suggested that their availability be regulated. Hedge studied rural suicides in villages of northern Karnataka over 1962 to 1970 and stated the suicide incidence rate to be 5.7 per 100,000 population. Reddy, in 1993, reviewed high rates of farmer suicides in Andhra Pradesh and its relationship to farm size and productivity.

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Reporting in popular press about farmers suicides in India began in mid-1990, particularly by Palagummi Sainath. In the 2000, the issue gained international attention and a variety of Indian government initiatives.

National Crime Records Bureau, an office of the Ministry of Home Affairs Government of India, has been collecting and publishing suicide statistics for India since the 1950, as annual Accidental Deaths & Suicides in India reports. It started separately collecting and publishing farmers suicide statistics from 1995.

## II) Causes :-

Various reasons have been offered to explain why farmers suicide in India, including : floods, drought, debt, use of genetically modified seed, public health, use of lower quality pesticides due to less investments producing a decreased yield. There is no consensus on what the causes might be but studies show suicide victims are motivated by more than one cause, on average three or more causes for committing suicide. Panagariya states, “farm-related reasons get cited only approximately 25 percent of the time as reasons for suicide” and “studies do consistently show greater debt burden and greater reliance on informal sources of credit” amongst farmers who commit suicide.

A study conducted in 2014, found that there are three are three specific characteristics associated with high-risk farmers : “those that grow cash crops such as coffee and cotton; those with ‘marginal’ farms of less than one hectare; and those with debts of 300 Rupees or more”. The study also found that the Indian states in which these three characteristics are most common had the highest suicides rates and also accounted for “almost 75 % of the variability in state-level suicides”.

A 2012 study, did a regional survey on farmers suicide in rural Vidarbha (Maharashtra) and applied a Smith’s Saliency method to qualitatively rank the expressed causes among farming families who had lost someone to suicide. The expressed reasons in order of importance behind farmer suicides were – debt, alcohol addiction, environment, low produce prices, stress and family responsibilities, apathy, poor irrigation, increased cost of cultivation, private money lenders, use of chemical fertilizers and crop failure. In other words, debt to stress and family responsibilities were rated as significantly higher than fertilizers and crop failure.

### III) Ideas of suicides :-

Patel et. Al found that southern Indian states have ten times higher rates of suicides than some northern states. This difference, they claim, is not because of misclassification of a person's death. The most common cause for suicide in South India are a combination of social issues, such as interpersonal and family problems, financial difficulties and pre-existing mental illness. Suicidal ideation is as culturally accepted in south India as in some high-income countries. The high suicide rates in southern states of India may be, suggest Patel et al., in part because of social acceptance of suicide as a method to deal with difficulties. Suicide ideation among surviving family members of farmers suicide victims is another worry. Recent study shows that almost a third of suicide survivors (family members left behind) had suicide ideation in one month prior to assessment.

State government field surveys:-

The Government of Maharashtra, concerned about the highest total number of farmer suicide among its rural populations, commissioned its own study into reasons. At its behest, Indian Gandhi Institute of Development Research in Mumbai did field research and found the top causes of farmers suicides to be : debt, low income and crop failure, family issues such as illness and inability to pay celebration expenses for daughter's marriage, lack of secondary income occupations and lack of value-added opportunities.

### IV) State wise farmers suicides in India (2012) :-

Sr. No.	State	Total farmers suicides (Not normal)
1	Maharashtra	3786
2	Andhra Pradesh	2572
3	Karnataka	1875
4	Madhya Pradesh	1172
5	Kerala	745
6	Uttar Pradesh	
7	Gujarat	864
8	Tamil Nadu	499
9	Assam	344



10	Haryana	276
11	Rajasthan	270
12	Odisha	146
13	Jharkhand	119
14	Punjab	75
15	Bihar	68
16	Himachal Pradesh	29
17	Sikkim	19
18	Tripura	18
19	Uttarakhand	14
20	Arunachal Pradesh	11
21	Meghalaya	10
22	Mizoram	10
23	Jammu & Kashmir	10
24	Chhatisgarh	4
25	Goa	1

#### V) Effective responses to farmers suicide :-

The government appointed a number of inquiries to look into the causes of farmers suicide and farm related distress in general. Krishak Ayog (National Farmer Commission) visited all suicide prone farming regions of India then in 2006 published three reports with its recommendations. Subsequently former Prime Minister Manmohan Singh visited Vidarbha in 2006 and promised a package of Rs. 110 billion. The families of farmers who had committed suicide were also offered an ex gratia grant of Rs. 100,000 by the government, though this amount was changed several times.

##### 1) 2006 relief package :-

In 2006, the Government of India identified 31 districts in the four states of Andhra Pradesh, Maharashtra, Karnataka and Kerala with high relative incidence of farmers suicides. A special rehabilitation package was launched to mitigate the distress of these farmers. The package provided debt relief to farmers' improved supply of institutional credit, improved irrigation facilities, employed experts and

social service personnel to provide farming support services and introduced subsidiary income opportunities through horticulture, livestock, dairy and fisheries. The Government of India also announced an ex-gratia cash assistance from Prime Ministers National Relief Fund to the farmers. Additionally, among other things, the Government of India announced.

- In the Vidarbha region of Maharashtra, that had received considerable mass media news coverage on farmer suicides, all farmer families of Vidarbha in six affected districts of Maharashtra were given a cash sum of Rs. 05 million each, to help pay off the debt principal.
- Rs. 7.12 billion in interest owed, as 30 June 2006, was waived. The burden of payment was shared equally between the Central and the State government.
- The Government created a special credit vehicle for Vidarbha farmer, to the tune of Rs. 12.75 billion. Special teams comprising NABARD and banks were deputed to ensure fresh credit starts flowing to all farmers of the region.
- An allocation of Rs. 21.77 billion was made to improve the irrigation infrastructure so that the farmers of Vidarbha region had assured irrigation facilities in the future.

2) **Agricultural debt waiver and debt relief scheme, 2008 :-**

The Government of India next implemented the Agricultural debt Waiver and Debt Relief Scheme in 2008 to benefit over 36 million farmers at a cost Rs. 653 billion. This spending was aimed at writing off part of loan principal as well as the interest owed by the farmers. Direct agricultural loan by stressed farmers under so-called Kisan Credit Card were also to be covered under this Scheme.

**Regional initiatives:-**

Various state governments in India have launched their own initiatives to help prevent farmer suicides. The government of Maharashtra set up a dedicated group to deal with farm distress in 2006 known as the Vasantrao Naik Sheti Swavlamban Mission, based in Amravati. A group to study the Farmers Suicides was also constituted by the Government of Karnataka under the Chairmanship of Dr. Veeresh, Former Vice-Chancellor of Agricultural Universities and Prof. Deshpande as member.

**3) Maharashtra Bill to regulate farmer loan terms, 2008 :-**

The State government of Maharashtra, one of the most farmer suicide affected states, passed the Money Lending (Regulation) Act, 2008 to regulate all private money lending to farmers. The bill set maximum not legally allowed interest rates on any loans to farmers, setting it to be slightly above the money lending rate by Reserve Bank of India and it also covered pending loans.

**4) 2013 diversify income sources package :-**

In 2013, the Government of India launched a Special Livestock Sector and Fisheries Package for farmers suicide-prone regions of Andhra Pradesh, Maharashtra, Karnataka and Kerala. The package was aimed to diversify income sources of farmers. The total welfare package consisted of Rs. 912 million.

**5) Government response :-**

The government's response and relief packages have generally been ineffective, misdirected and flawed, states Surinder has focused on credit and loan, rather than income, productivity and farmer prosperity. Assistance in paying off outstanding principal and interest helps the money lenders, but has failed to create reliable and good sources of income for the farmer going forward. The usurious moneylenders continue to offer loans at interest rates between 24 and 50 percent, while income generating potential of the land the farmer works on has remained low and subject to weather conditions. Sud states that the government has failed to understand that debt relief just. Postpones the problem and lasting answer to farmer distress can only come from reliable income sources, higher crop yields per hectare, irrigation and other infrastructure security. Golait, in Reserve Bank of India paper, acknowledged the positive role of crop diversification initiative announced in government's response to reports of farmer suicides. Golait added, "Indian agriculture still suffers from

- a) Poor productivity
- b) Falling water level
- c) Expensive credit
- d) Distorted market

- e) **Many middlemen and intermediaries who increase cost but do not add much value**
- f) **Laws that stifle private investment**
- g) **Controlled prices**
- h) **Poor infrastructure**
- i) **Inappropriate research**

Thus the approach with mere emphasis on credit in isolation from the above factors will not help agriculture. Furthermore, recommended Golait, a more proactive role in creating and maintaining reliable irrigation and other agriculture infrastructure is necessary to address farmer distress in India.

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## **Changes in Biochemical Properties of Cow Manures During Processing by Earthworm (*Eudrilus eugeniae*) and the Effect of Crop Growth**

Mr. R. S. Tambe\*

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### **Abstract:-**

The biochemical changes in fresh cow manure caused by the earthworm *Eudrilus eugeniae* were measured over a period of four to five months, under controlled laboratory conditions. Earthworms were introduced into each of four plastic containers, containing fresh cow manure (2500 g), and four containers containing manure but without earthworms served as controls. Earthworms reduced the pH and decreased the moisture content in the manure. The C:N ratio of the manure with or without earthworms decreased progressively from 35 to 23. The ash and total nitrogen contents increased greatly for a few weeks after the introduction of earthworms, reflecting a rapid breakdown of carbon compounds and mineralization of nitrogen by the earthworms. CO<sub>2</sub> evolution decreased rapidly (44 %) one week after the introduction of earthworms, and continued at a lower rate throughout the 15 weeks (51 % reduction as compared to 22 % without earthworms), indicating increasing stability of the organic matter. Earthworms reduced microbial biomass early in the process, but enhanced nitrogen mineralization and increased the rates of conversion of ammonium-nitrogen into nitrate. The major general effect of earthworms on the organic wastes was to accelerate the maturation of the organic wastes as demonstrated by enhanced growth of crops.

**Key Words:-** Biochemical properties, Manure, *Eudrilus eugeniae*, Decomposition.

### **Introduction :-**

Fertilization is an important agricultural measure that affects soil quality and sustainable utilization of soils.

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Low inputs of organic materials and excessive use of mineral fertilizers have contributed to a general reduction in soil organic carbon (SOC) contents, with a consequent decline in agricultural soil quality. The earthworm species most commonly utilized for the breakdown of organic wastes are *Eisenia fetida* (Savigny) and its related species *Eisenia andrei* (Bouché). Their biology and main environmental requirements have been studied extensively (Hartenstein et al. 1979; Kaplan et al. 1980; Reinecke & Venter 1987; Venter & Reinecke 1988; Reinecke & Viljoen 1990; Haimi 1990; van Gestel et al. 1992; Domínguez & Edwards 1997). The appropriate utilization of manures and/or crop residues within management systems can increase levels of plant nutrients and enhance soil microbial biomass, activity and diversity. A considerable number of studies have focused on the effects of organic manures on soil biochemical properties, regulations for field application and disposal of animal manure has become more rigorous, the interest in using earthworms as an ecologically sound system for manure management has increased tremendously. Various researchers have examined the potential utilization of earthworm-processed wastes, commonly referred to as Vermicompost, in the horticultural and agricultural industries. Whether used as soil additives or as components of horticultural media, Vermicompost usually enhanced seedling growth and development, and increased productivity of a wide variety of crops (Edwards & Burrows 1988; Wilson & Carlisle 1989; Mba 1996; Buckerfield & Webster 1998; Edwards 1998; Subler et al. 1998; Atiyeh et al. 1999). Enhancement in plant growth and productivity has been attributed to the physical and chemical characteristics of the processed materials. Vermicompost are divided peat-like materials with high porosity, aeration, drainage, and water-holding capacity (Edwards & Burrows 1988). They have a large surface area, providing strong absorption capability and retention of nutrients (Shiwei & Fuzhen 1991).

Vermicomposting is the process by which worms are used to convert organic materials (usually wastes) into a humus-like material known as Vermicompost. The goal is to process the material as quickly and efficiently as possible. These two processes are similar but different. If your goal is to produce Vermicompost, you will want to have your maximum worm population density all of the time. If your goal is to produce worms, you will want to

keep the population density low enough that reproductive rates are optimized. Both of these processes will be described in some detail in this manual. The biochemical parameters include variables directly related to microbial activity (microbial biomass carbon, soil respiration etc.), and extracellular enzymes involved in the carbon (C), nitrogen (N) and phosphorus (P) cycles in soil, which are more sensitive to environmental stress, play a major role in the degradation of organic matter, and provide rapid and accurate information on soil quality. Most organic manures added into soil contain polymeric compounds, and thus the decomposition of these organic matters depends on the microbial production of extracellular enzymes and their break down should occur before taking up of low molecular weight organic molecules by microbial cells. There are only few literature references that have looked into the process, by the action of earthworms as they fragment the organic matter, resulting in the formation of a Vermicompost with physicochemical and biological properties which seem to be superior for plant growth. The main objective of this experiment was to monitor the primary changes in the biochemical properties of cow manure during processing by earthworms (vermicomposting) under controlled environmental conditions. To be compatible with agricultural uses and to avoid possible adverse effects on plant growth, organic wastes should be transformed into a humus-like material and be sufficiently stabilized for plant growth (Saviozzi et al. 1988).

### **Materials and Methods :-**

#### **A) Collection of different organic manures**

In this experiment are collected different organic manures and mixed in livestock and green manures with the effect of different biochemical parameter. The feeding material was subjected to aerobic composting and was placed in the plastic pots after a week when the mixture was partially decomposed. Moisture content of the compost was maintained at 60–70%. The earthworm *Eudrilus eugeniae* obtained from the vermicomposting unit, in the plastic pots at 50 worms per pot. The experimental plastic pots were kept under shade and covered with bags to avoid direct sunlight. The Vermicompost was harvested when all the crop residues and byproducts and organic wastes were completely turned into castings. The Vermicompost and Vermicompost wash samples were collected in sterile containers before harvesting the compost. About 4 week old 500 adult earthworms were inoculated in each



bin in triplicate. *Eudrilus eugeniae* were used for the purpose. These worms were obtained from a local vermicomposting unit. Earthworms were cultured for 70 days until the bedding material was fully converted into Vermicompost. Earthworms were kept at 15-20OC. Humidity was maintained at 70-75% throughout the experiment.

**Result and Discussion:-**

The moisture contents of the manure increased with time, irrespective of the presence or absence of earthworms. However, the percentage increase was less with earthworms (from 75 % to 80 %) than without them (from 78 % to 86 %) although the differences were not statistically significant. There were only very slight changes in pH values in both treatments. The pH values in earthworm containers decreased slightly after week 4, whereas with no earthworms, the pH value of the manure increased and moved towards neutrality. The differences in pH resulting from addition of earthworms were highly significant over the whole period of the experiment. The C:N ratio, one of the most widely used indices for maturity of organic wastes, decreased progressively with or without earthworms. There was no difference in the C:N ratios between the two treatments after 17 weeks. This over-all decrease in the C:N ratio was associated with an increase in total nitrogen during the four months of study (Fig. 2). However between week 2 and week 10, the decreases in the C:N ratio and the increases in total nitrogen were significantly greater in the manure with earthworms.

**Changes of manure during processing by earthworms**

**Table 1. Growth (mean ± standard deviation) of crop plants in manure, vermicomposted manure, and in a commercial potting medium (Pro-Mix)**

Particular	Height (cm)	Root length (cm)	Shoot dry weight (g)	Root dry weight (g)	Root : shoot ratio
Manure (control)	2.7+0.5 b	5.7+0.7 c	0.01+0.004 c	0.004+0.002 c	0.38+0.16 b
Vermicompost	5.7+0.8 a	9.8+1.7 b	0.02+0.009 b	0.012+0.005 b	0.41+0.16 a
Pro-Mix	5.5+0.6 a	12.7+2.5 a	0.07+0.010 a	0.017+0.005 a	0.32+0.07 b

**Table 2. Growth (mean ± standard deviation) of fertilized and unfertilized crop plants in manure, vermicomposted manure, and in a commercial potting medium (Pro-Mix)**

Particular	Leaf area (cm)	Shoot dry weight (g)	Root dry weight (g)	Root : shoot ratio
With fertilizer Manure (control)	3.0+0.7 -b	6.2+0.5- c	0.02+0.005-c	0.24+0.05 - a
Vermicompost	6.7+0.5- a	7.9+1.3 -b	0.03+0.005- b	0.18+0.04 - b
Pro-Mix	6.1+0.3- a	12.2+3.0 -a	0.05+0.012- a	0.24+0.07 - a

#### Conclusion:-

The results suggest that earthworms play a significant role in processing cow manure, since the earthworm activity accelerated the process of manure decomposition and stabilization and promoted biochemical characteristics that were favorable for plant growth. Vermicompost carried out by these worms was safe for agriculture use and could be very beneficial for increasing the productivity of our crops by using natural fertilizers rather than chemical fertilizers which we have to import from India. The worm tissue can also be safely used as feed for the animals such as poultry. The worm tissue is rich in amino acids and vitamins which can be given to animals as a food supplement. Vermicomposting is set to become increasingly popular in the next century as it yields rich organic fertilizers. In summary, we demonstrated that earthworms could alter the biochemistry of cow manure considerably and accelerate the stabilization and maturity of the organic waste. Our experiment of processing cow manure by earthworms may not fully duplicate large-scale commercial conditions, but provides valuable insight about the process and the changes brought about by earthworm activity. It appeared that the first few weeks after introduction of earthworms to the manure were the most critical. During this period, most of decomposition and stabilization of manure by earthworms occurred although pH did not change much. The C:N ratio decreased significantly and the ash and total nitrogen contents increased. As the vermicomposting process progressed, biological activity began to slow down, due to a depletion of readily available organic matter, and most of the nitrogen was converted into the nitrate form. The final product, in contrast to the manure from which it was derived, was more mature and stabilized which was demonstrated by the increased plant productivity it produced. The cost of chemical fertilizer is increasing day by day and farmers cannot buy needed fertilizers, in this contest Vermicomposting technology is very necessary for our poor farmers.

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## **Spatial and Temporal Changes of Mangrove Forests in Mumbai and Suburban Region**

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### **ABSTRACT –**

Mangrove ecosystem is highly productive but very sensitive and fragile. Mangrove forest not only support coastal marine organisms but also protect the coast from erosion and serve as breeding, feeding and nursery grounds for estuarine and marine organisms, they are also important for capture and culture fisheries. Therefore monitoring mangrove habitat from time to time is an essential component for conservation and sustainable development of Marine ecology. The sustainability of the mangroves ecosystem is of paramount importance for Mumbai. One of the premier megacity of the world with a population of more than 20 billion. Mangroves around Mumbai form a fragile ecosystem that is exposed to pollution and other demographic pressures, various development projects resulting in depletion of coastal resources, destruction of critical habitats, disruption of ecosystem, loss of biodiversity. The livelihood of the fisherman in Mumbai depends on mangrove forests. The importance of Mangroves came into light in the 2004 tsunami along the east coast of India. Present paper studies the spatial and temporal changes of mangrove forest cover in Mumbai from the year 1990 to 2012, and compare it with the overall distribution in India

**Keywords – Mangroves**

### **INTRODUCTION –**

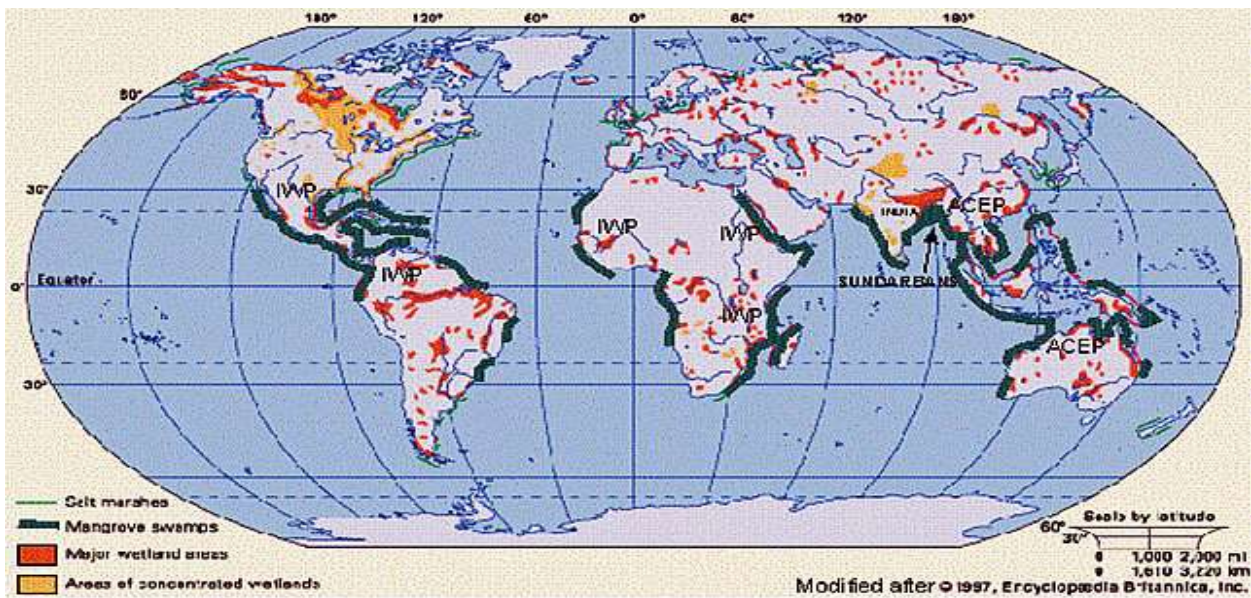
Mangroves are woody plants and shrub with a thick, partially exposed network of intertwined roots that grow down from the branches into the water and sediment, found in the upper intertidal zones of saltwater areas, primarily in tropical and subtropical coastal regions within 30° of the equator and form low diversity forests with complex food webs and unique ecosystem dynamics. Mangroves dominate three quarters of tropical coastlines and cover roughly 172,000 sq. km. of the earth's surface in the large river deltas, estuaries and barrier islands. The richest mangrove communities occur in tropical and sub-tropical areas, i.e., between the 30°N and 30°S latitudes where the water temperature is greater than 24°C in the warmest month, where the annual rainfall exceeds 1250 mm and mountain ranges greater than 700m high are found close to the coast.

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Sunderbans are the largest mangrove forest in the world both in size as well as biodiversity. The total area of mangroves in India is about 6,740 sq. km, which is about 7% of the world's total area of mangroves. Of the total mangroves 80% are present along the east coast, mostly forming the Sunderbans (West Bengal), Bhitarkanika (Odisha), Pichchavaram (Tamil Nadu) and the Andaman & Nicobar mangroves.

Map No. 1 - World distribution of Mangrove forests.



### Importance of mangrove forest

- a. Buffer Zone between the land and sea.
- b. Protect the land from erosion.
- c. Play an invaluable role as nature's shield against cyclones, ecological disasters and as protector of shorelines.
- d. Breeding and nursery grounds for a variety of marine animals.
- e. Harbour a variety of lifeforms like invertebrates, fish, amphibians, reptiles, birds and even mammals like tigers.
- f. Good source of timber, fuel and fodder.
- g. Main source of income generation for shoreline communities like fisherfolk.



- h. Save the marine diversity, which is fast diminishing.
- i. Purify the water by absorbing impurities and harmful heavy metals and help us to breathe a clean air by absorbing pollutants in the air.
- j. Efficient Carbon sinkers.

**Importance of Mangroves for Mumbai.**

6,135 hectares of mangrove land spread over Mumbai, Navi Mumbai, Parts of Thane and up to Panvel. Mangroves represent the spirit of Mumbai. As the carbon sinks mangroves are invaluable. Mangrove cover of Mumbai is the second lunge after Sanjay Gandhi National park. But each day, millions of citizens in Mumbai pass these hardy plants imagining they are little more than dirty, muddy weeds growing pointlessly along the shoreline. By trapping silt, mangroves maintain the integrity of Mumbai’s shoreline. This is a vital service to the city of Mumbai as it is very prone to erosion, having been built on reclaimed land that is battered by the sea on all three sides. Therefore it is the need of the hour to save this invaluable resource especially in the case of Mumbai where the destruction is taking place on a daily basis.

**Study Area –**

The study area is Mumbai, situated along the west coast of India on the coordinates 18<sup>0</sup> 58’30’’N 72 49’33’’ E and is the capital city of Maharashtra. It is the deep natural Harbour and one of the most popular metropolitan city in the world.



**Mangroves in Mumbai**

**Objectives –**

- 1) To Study the spatial and temporal changes of mangrove forest.
- 2) To study the causes of destruction of mangroves In Mumbai.
- 3) To give measures to prevent further destructions.

**Database and Methodology –**

Various sources have been used for the data collection. Reports of Ministry of Environment and Forest are referred for the area under mangroves in India. The Data of changes in mangroves in Mumbai was taken from various sources including newspapers and websites. The Aerial imageries are also been used to assess the changes. Imageries showing the destruction of Mangroves used for the purpose.

**Table No. 1 Area under Mangrove forest in Mumbai (1990 to 2012)**

Year	Sparse Mangroves (km) <sup>2</sup>	Dense Mangroves (Km) <sup>2</sup>	Total Area (Km) <sup>2</sup>
1990	75.08	17.86	92.94
1996	43.44	23.47	66.91
2001	30.08	25.50	56.40
2006	24.08	26.04	50.12
2012	19.09	26.98	46.07

**Table no. 2 Area under mangrove forest in India (2001 – 2012).**

Year	very dense mangroves (km) <sup>2</sup>	Moderately dense mangroves (km) <sup>2</sup>	Open mangrove (km) <sup>2</sup>
2001	2859	-	1623
2003	1162	1657	1642
2005	1147	1629	1669
2009	1405	1659	1575
2011	1403	1658	1601

**Observation and Discussion –**

It is evident from the above data that the area of sparse mangroves has declined considerably whereas the area of dense mangroves has increased in the study region (Table No. 1). The change in the area of mangroves in Mumbai for a period of 11 Years from 1990 to 2012 reveals that a total area of 46.87 km<sup>2</sup> was lost. There was a loss of 55.99 km<sup>2</sup> in sparse mangroves and gain of 9.12 km<sup>2</sup> in the dense mangrove area during 1990 to 2012. It is observable from data that during 2012 the Mangrove coverage was 46.07 km<sup>2</sup> compared to 92.94 km<sup>2</sup> in the year 1990. The biggest decline in the mangrove forest cover can be



observed from 1990 to 1996 (26.03 km<sup>2</sup>) which was mainly of sparse mangroves. After 1996 mangrove cover has declined but at the decreasing rate which is a good sign. Sparse mangrove cover declined considerably from 1990 to 2012, these sparse mangrove cover area is in fact the future areas of dense mangrove cover.

If we compare this result with the observation of area of mangroves in India, it is evident that the situation is much different in Mumbai. It can be observed from table no 2 that area under dense mangroves cover has declined considerably from 2001 to 2005 but it again increased may be because measures taken after the 2004 Tsunami destruction in coastal areas. There are no measure changes in moderately dense mangroves and open mangroves from 2001 to 2011. Also the total coverage is more or less same, this shows that how much destruction is taking place in Mumbai. Imageries taken on different dates are very useful to study the spatial change; following are some imagery showing the destruction of mangroves.

#### **Conclusion –**

Mangroves forest cover is essential for Mumbai as it acts as a buffer for reclaimed land of Mumbai and saves it from severe erosion; they are also important carbon sinkers for Mumbai so it is necessary to save this invaluable resource. Public participation needed to conserve the mangroves, literate population of Mumbai should know the importance of mangroves. There are laws, but proper implementation of these laws should take place. Government now taking strict measures to save the mangroves in Mumbai

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## Causes of Farmers Suicides in Maharashtra

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### ABSTRACT

For last few years every other day we read the news of farmers committing suicides. The number of farmers who have committed suicides since 1997 has crossed 1 lakhs. In this context the actual problems being faced are to be understood and analysed. Innovative remedies have to be thought of which are to be implemented with sincerity by the Government and the implementing agencies, along with putting in place ways to rehabilitate the affected farmers. An attempt has been made in this article to address the issue of farmers plight leading to suicide and measures to address the issue have been suggested. Several studies have been conducted by the Government and social science organizations to analyse the agrarian crisis and farmers suicides. Based on my experience as District Development Manager (DDM) in District Betul of Madhya Pradesh, which incidentally is adjacent to, identified distress districts in Maharashtra. I have tried to summarise causes of suicides and suggested remedies in the paper. Central and State Government have announced the relief packages to the suicide affected families in Maharashtra. NABARD is the implementing agency of the package provided by Central Government. In the budget of 2008-09 Honourable Finance Minister has also announced massive write off to the tune of Rs.60000 crore of the outstanding loan of small & marginal farmers and OTS for other farmers.

### Introduction

Agriculture provides the principal means of livelihood for over 60% of India's population. Despite a steady decline in its share to the gross Domestic Product (GDP) agriculture remains the largest economic sector in the country. Low and volatile growth rates under the sector and the recent escalation of an agrarian crisis in several parts of the country pose a threat not only to national food security but also to the economic well being

of the nation as a whole. In 1947 the share of Agriculture in total GDP was 50%. Gradually it declined and has now come down to about 20%. Still however 60% population depend on agriculture for the survival. In 1988-89 i.e. prior to introduction of Financial Sector Reforms, growth rate in Agriculture in India was 15.4%, which has come down to 9.4%(2006-07). Due to rapid growth of rural population and division of families the farmland has undergone rapid fragmentation. Presently 80% of the farmland holding are with the small and marginal farmers owning land up to 5 acres. For this category of farmers cost of production by way of farm inputs has increased manifold over the years while the productivity of the land remained at the same level and sale price of farm produce has not commensurately increased. These factors have driven farmers to the debt trap and have caused distress leading to suicide. My experience in the field has shown that smaller the landholding higher is the cost of production. The distressed economy of small scale crop cultivation is further accentuated by lack of knowledge, scientific application of crop management, diversification practices, inappropriate system such as non availability of quality input material in time, inadequate irrigation facility, non-remunerative prices, dominance of middlemen in Agricultural Marketing Structure. It is encouraging to see that our country is one of the fastest growing economies in the world. Reform process in most of the economic sectors is in place. There is healthy competition in almost all the sectors leading to cost reduction. GOI has planned to achieve 10% growth by 2012, but all this cannot be achieved unless the targeted growth is ensured for Agriculture sector.

**Causes:**

- 1.Repeated crop failure,**
- 2.Inability to meet the rising cost of production (farmers have been spending more on fertilizers even while crop performance has been showing a declining trend), and**
- 3.Indebtedness due to a host of reasons ranging from a daughter's marriage to digging a well which eventually bore no water,**
- 4.These causes arose out of a larger picture of globalization & the resultant neglect of**

## **agricultural community in India**

### **Major Factors contributing to suicides in Maharashtra**

Saying in Marathi "Farmer takes the birth in debt and die in the same condition". This was the position of farmers before independence and it still continue after 60 years of independence. If we analyse the suicides by farmers in Maharashtra it is revealed that it is higher in Vidarbha region of the State where farmers preferred cultivation of "white gold" i.e. cotton - a risky venture that suffered due to non-availability of quality seeds coupled with the farmers or incapacity to buy costly Bt. cotton seeds. They could also not get remunerative price for their produce. According to Dr. M.S. Swaminathan, although 60% people in India depend on agriculture and Agriculture Sector contributes 25% of National Income over the period investment and production in agriculture has declined. In developed world the percentage of dependence of population on agriculture is much less e.g. in USA it is only 2% and income from agriculture is just 4%.<sup>7</sup> There are related issues of quality for export and competition in global market. The answer to the question as to why the farmers are committing suicides? lies in a combination of factors such as crop failure, shifting to more profitable but risky (in terms of output, quality and prices) cash crops like cotton/ sugarcane/ soyabean, exorbitant rate of interest and other terms and conditions of loans availed from money lenders, lack of non farm opportunities, unwillingness to adopt to scientific practices, non availability of timely credit from formal channel, absence of proper climate/ incentive for timely repayment of bank loan, etc. At some places even though water is available but can't be exploited fully due to insufficient power supply. Huge expenditure on children's education and sudden demand of money for health considerations and marriage, etc. in the family are also major contributors for stress in farming community. Inconsistency of rainfall during monsoon, absence of support mechanism for marketing of agriculture produce also contributed to uncertainty and financial risk of the farmers. To commit suicide is not normal but generally occurred for farmers due to fear of pressure of moneylenders e.g. if they fail to repay the loan their land

**will be forcibly taken away. Their economic condition in many cases changes to such an extent that the farmers are unable to face the society. In this situation of loneliness and in absence of any institutional or social mechanism to fall back upon, farmers were forced to commit suicide. For farmers to come out of the stressful situation a system to address the various issues discussed in the earlier paragraphs have to be evolved through an institutional mechanism with necessary arrangement for review and follow up. A rehabilitation programme which addresses repayment of overdue interest, supply of quality inputs for next crop, insurance against natural calamity, opportunity of supplementary income through nonfarm activities, provision of forward linkage such as marketing and storage, extension services, etc. has to be devised and implemented.**

## **CONCLUSION**

**For upliftment of the farmers there is need for a joint initiative by State Government, Central Government and Financial Institutions. There is need of,**

- 11) Timely and adequate support by way of credit to farmers with focusing small and marginal farmers to have them modern equipment for improved agricultural productivity.**
- 38) ii) To issue Kisan Credit Cards to all the eligible farmers to have them access to get ST, MT and LT loan from all the banks.**
- 39) To form the SHGs of Tenant farmers/ share croppers & agricultural workers and give them micro-credit through banks.**
- 40) Encourage the farmers to adopt allied activities like dairy, fishery, poultry etc. with farming activities.**
- 41) Diversification/crop rotation in agricultural production in changed scenario.**
- 42) Adoption of upgraded technology inputs along with provision of infrastructure inputs**

**like power at subsidized cost, supply of inputs like seeds, fertilizers, tractors and credit provision through all nationalized banks.**

**43) Adoption of Non-Farm activities with allied agricultural activities.**

**44) Arrangements of marketing /forward linkages /contract farming to sell their produce at remunerative prices. If these facilities are given to farmers they may achieve self-sufficiency in agricultural production. There is need for major review of agricultural policy to meet the changing needs of both producers and consumers.**

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# **Caste, Land and Income in Rural India: Implication for Inclusive Development**

Narayan Gore, Rajesh Raushan, Subhash Jagdambe

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## **Abstract**

**In India more than two third of population is still living in rural India who are directly or indirectly dependent on agriculture for their income generation. Agriculture contributes on overall growth and development of country and rural development particularly. It is highly recommended that higher agricultural and rural growth rates are likely to have a strong, immediate and favourable impact on poverty and rural development through upliftment of standard of living of low and middle class people. Secondly, the social structure of the society India particularly in rural areas also plays an important role in shaping the nature of cohesive development.**

**Not only economic resources in societies vary according to the level of development and structural features of society, but also different groups tend to have differential access to these resources. Power enjoyed by the social groups also differ and offers another related social disadvantage and deprivation. These absolute as well as relative disadvantages and deprivation make them poor on development and well being. Broadly, caste conventionally implied the location of an individual/group in hierarchical structure of society. It determines differential access to power, privilege and desirable resources to achieve or produce better outcomes.**

**In India, traditional caste system is deeply rooted in the physic of masses in rural India resulted in poor outcomes on various developmental indicators like health, education, employment, economic prosperity etc among lower caste compared to the high caste group. Possibly, this can also be seen in agricultural farming. The prevailing disparity on other outcomes may have interaction in agricultural farming also. But, when all these dimensions of poverty, deprivation and discrimination considered under the single umbrella, the interaction and relational attributes are in illusion.**

**In the context, the study seeks to analyse the disparity in agricultural farming practices and income generation among social groups in India for better understanding of cohesiveness. It can be understand through disparities in crop productivity and income from farming arising out of discriminatory access to farming inputs. The agricultural production is critically dependent on the physical and financial access to agricultural inputs. Hence, it is important to understand differences on various input, production and income generated to different social groups.**

**Kea Words: Caste, Land, Income, Inclusive Development.**

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## **Introduction**



**Agriculture is the back bone on Indian economy in terms of providing livelihood to more than forty five percent of total population. Agriculture sector in India is subsistence based farming with small-holder farmers comprises the foremost share of cultivators. Cultivators divided in social hierarchy like ST, SC, OBC and forward Caste. In rural India, caste defines culture of exploitation and also determine access to land (Chakravarti, 2001: Prasad, 2015 ). Among this social hierarchy it seems huge diversity in conducting agricultural activities (Rao 2017). Agriculture contributes on overall growth and development of country and rural development particularly. It is highly recommended that higher agricultural and rural growth rates are likely to have a strong, immediate and favourable impact on poverty and rural development through upliftment of standard of living of low and middle class people. Secondly, the social structure of the society India particularly in rural areas also plays an important role in shaping the nature of cohesive development.**

**Not only economic resources in societies vary according to the level of development and structural features of society, but also different groups tend to have differential access to these resources (Deshpande, A. & Smriti, S. (2015). Power enjoyed by the social groups also differ and offers another related social disadvantage and deprivation. These absolute as well as relative disadvantages and deprivation make them poor on development and well-being. Broadly, caste conventionally implied the location of an individual/group in hierarchical structure of society. It determines differential access to power, privilege and desirable resources to achieve or produce better outcomes.**

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### **Data and Methodology**

**To fulfil the above said objective the present study used secondary data source collected by National Sample Survey Office on Situation Assessment Survey of Agriculture Household for the agriculture year July 2012-June 2013. The survey has been carried out across rural India on various aspect of agriculture household and their farm-related activities. The survey was carried out in two visits. Visit one for kharif season (July to December 2012) and visit two for Rabi season (January to July 2013). In visit one, 35200 and in visit two 34907 number of household were surveyed. Furthermore, study followed the NSSO classification of land categorisation namely, landless, marginal, small, semi-medium, medium and large. The current study also selected major crops such as cereals, pulses, oilseeds, fibres and plantations crops for the analysis. Commodities like fruits, vegetables and fodders have included under the category of**

‘Others’. For income and expenditure analysis the results are presented separately for kharif and Rabi seasons.

## Results and Discussion

### Distribution of Land across Caste in India

The distribution of household (HH) across land-size categories has provided into table 1 and table 2. It seems that the percentage of households in each land-holding category declines with the increasing size of operational holding across all social groups (Table 1). Majority of land holding in India is found of marginal and small. Around 70 percent of HH found within the marginal land holdings, followed by small holding for more than 17 percent. It comprises more than 87 per cent ranges from 82.52 percent among SC to 63.84 percent among Forward Caste. Further, the percentage of farm households with land size of greater than 4 hectares (medium and large farmers) is around 6.67 percent among Forward caste, while among rest of the social groups; especially among the SCs it is lowest of only 1.45 percent. However for SC/ST and non-SC/ST can be observed from Table 1.

**Table 1: Distribution of HH according to Land Size by Social Groups in India: 2013 (In %)**

Social Group	ST	SC	SC/ST	OBC	Forward Caste	Non-SC/ST	Total
Landless	0.12	0.23	0.18	0.38	0.10	0.28	0.25
Marginal	65.80	82.52	74.95	68.87	63.84	67.09	69.43
Small	22.51	11.36	16.40	17.11	17.87	17.38	17.09
Semi-Medium	9.34	4.44	6.66	9.62	11.52	10.29	9.21
Medium	2.13	1.38	1.72	3.55	6.00	4.41	3.61
Large	0.10	0.07	0.08	0.46	0.67	0.54	0.40
Total	100	100	100	100	100	100	100
Total	12118594	14668128	26786722	40979438	22434980	63414418	90201140

*Source: Authors' calculation based on the Situation Assessment Survey of Agricultural Household (SASAH), NSSO 70<sup>th</sup> Round, 2013.*

**Table 2: Distribution of HH according to Land Size across Social Groups in India: 2012-13 (In %)**

Social Groups	Landless	Marginal	Small	Semi-medium	Medium	Large	Total
ST	6.55	12.73	17.70	13.62	7.92	3.25	13.44
SC	14.72	19.33	10.81	7.84	6.21	2.94	16.26
ST/SC	21.27	32.06	28.50	21.46	14.12	6.20	29.70

<b>OBC</b>	<b>68.72</b>	<b>45.07</b>	<b>45.48</b>	<b>47.45</b>	<b>44.59</b>	<b>52.33</b>	<b>45.43</b>
<b>Forward Caste</b>	<b>10.01</b>	<b>22.87</b>	<b>26.01</b>	<b>31.09</b>	<b>41.29</b>	<b>41.48</b>	<b>24.87</b>
<b>Non-ST/SC</b>	<b>78.73</b>	<b>67.94</b>	<b>71.50</b>	<b>78.54</b>	<b>85.88</b>	<b>93.80</b>	<b>70.30</b>
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

*Source: Authors' calculation based on SASAH, NSSO 70<sup>th</sup> Round, 2013.*

Some of the households fall in the landless category with no operational land at the time of the survey. Most of these were land owning households who have leased- out all their land. Although the survey aimed to cover only the farmer households operating land (either own or leased in), a miniscule percentage of surveyed households were not as per this criterion. So, those have been dropped from the analysis.

The average size of operational land holding is more or less same for all social groups except for the SC (Table 3). For own land, ST households have more own land (0.9 hectare) compared to the SC household. Whereas, SC households having lesser size of ownership holding (0.5 hectare). Subsequently the average size of leased-in land for SC is more compared to leased-out, their size of operational holding is found only about half (0.65 hectare) as compared to 1.30 hectare of forward caste households. For ST, it is found lesser average size of both leased-in (0.06 hectare) and leased-out (0.02 hectare) compare to all social groups. For OBC, the total operational land holding is found just more (1.04 hectare) than ST. Notably among all the social groups; the operational size of land holding has been decreasing over the period.

**Table 3: Average Land Size of Land Holding by Social Groups in India (In Hectare)**

Code	Owned	Leased-in	Neither own nor leased in	Leased out	Total Oper. Holding
ST	0.93	0.06	0.03	0.02	1.00
SC	0.52	0.14	0.01	0.01	0.65
SC/ST	0.71	0.11	0.02	0.02	0.81
OBC	0.95	0.10	0.01	0.02	1.04
Forward Caste	1.17	0.16	0.02	0.05	1.30
Non-SC/ST	1.03	0.13	0.01	0.03	1.13
Total	0.93	0.12	0.01	0.03	1.04

*Source: Authors' calculation based on SASAH, NSSO 70<sup>th</sup> Round, 2013.*

**Table 4: Distribution of Land Possession across Social Groups in India: 2013 (%)**

Social Group	Owned	Leased-in	Neither owns or leased in	Leased out
ST	93.01	6.35	2.89	2.24
SC	79.58	21.56	0.81	1.95
ST/SC	87.10	13.04	1.97	2.12
OBC	91.09	10.04	0.93	2.05
Forward Caste	89.99	12.58	1.38	3.95
Non-SC/ST	90.64	11.07	1.11	2.83
Total	89.82	11.53	1.31	2.66

Source: Authors' calculation based on SASAH, NSSO 70<sup>th</sup> Round, 2013.

Table 4 provides information on proportion of land possession by type. Among all social groups, SC households have highest dependency on leased-in land. Whereas forward caste and OBC having 12.6 percent and 10.1 percent leased in land. Comparing SC/ST and non-SC/ST, the leased-in land has found more among SC/ST group compared to non-SC/ST group (Table 4). The operational holding of SCs comprises of 21.56 percent leased-in land, while for the rest three social groups, the percentage of leased-in land in total land possessed is less than 10 percent. Among the tribal households, only about 6.35 percent of land is found under leased-in and 2.9 percent of the land cultivated by them is neither owned nor leased-in. The land possession among OBC comprises of 10.4 percent leased-in and around 2 percent leased-out.

#### Principal source of Income among Agricultural Households

Across rural India major source of income among agricultural households was crop cultivation, livestock farming, other agricultural activities, non-agricultural enterprises, wages/salary, pension, remittances, and other sources which were not included under it. Under the study, cultivation, livestock and other agricultural activities have been included under Agriculture. Whereas; pension, remittances and other source has clubbed under other sources of household income. Rest has been kept as it is. The group contributing the largest share of the household's income was taken to be its principal source of income. Agriculture was found main source for 68 percent of agricultural households (Chakravorty, S *et.al* 2016) followed by 22 percent were dependent on wages and salary (Table 5). Along the caste line, study noticed that the wage was highest among the SC households followed by ST and OBC caste. By and large, SC is having very less land holdings reflected into their main source of income as for only 56 percent of SC households; agriculture remained main source of household income. Among OBC and forward caste, agriculture contributes 70-71 percent of household incomes. Considering SC/ST and non-SC/ST, around 30 percent SC/ST households were dependent on wages compared to 19 percent among non-SC/ST households in rural India. Overall, non-agricultural households contributed for around less than 5 percent

varied from around 3 percent among SC/ST to 5.4 percent among non-SC/ST households.

**Table 5: Principle Source of Income among Agricultural HH in India: 2013 (In %)**

	Agriculture	Non Agricultural Enterprises	Wages	Others	Total
ST	72.42	1.72	24.29	1.57	100
SC	56.21	4.00	33.53	6.26	100
SC/ST	63.54	2.97	29.35	4.14	100
OBC	69.70	5.32	20.04	4.95	100
Forward Caste	71.04	5.44	17.00	6.51	100
Non-SC/ST	70.17	5.36	18.96	5.50	100
Total	68.20	4.65	22.05	5.10	100

*Source: Authors' calculation based on SASAH, NSSO 70<sup>th</sup> Round, 2013.*

**Table 6: Share of Cultivated Land under Different Crops in India: 2013 (In %)**

	ST	SC	SC/ST	OBC	Forward Caste	Non-SC/ST	Total
	<b>Kharif</b>						
Cereals	66.44	60.34	64.01	52.51	52.12	52.36	55.19
Pulses	4.90	6.89	5.69	7.59	5.63	6.84	6.56
Oilseeds	8.90	13.70	10.81	16.99	11.85	15.02	14.00
Fibers	9.33	6.86	8.35	9.28	14.97	11.46	10.71
Plantation	6.42	0.93	4.24	2.12	1.89	2.03	2.57
Others	4.02	11.28	6.91	11.51	13.54	12.29	10.98
Total	100	100	100	100	100	100	100
	<b>Rabi</b>						
Cereals	46.89	61.17	54.24	60.05	61.56	60.64	59.37
Pulses	15.05	14.12	14.57	15.02	11.03	13.48	13.69
Oilseeds	9.52	10.35	9.95	8.78	9.72	9.14	9.30

<b>Fibers</b>	<b>6.38</b>	<b>3.03</b>	<b>4.66</b>	<b>2.33</b>	<b>2.27</b>	<b>2.31</b>	<b>2.77</b>
<b>Plantation</b>	<b>10.09</b>	<b>3.89</b>	<b>6.90</b>	<b>4.49</b>	<b>3.06</b>	<b>3.93</b>	<b>4.52</b>
<b>Others</b>	<b>12.07</b>	<b>7.44</b>	<b>9.68</b>	<b>9.32</b>	<b>12.37</b>	<b>10.50</b>	<b>10.34</b>
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Source: Authors' calculation based on SASAH, NSSO 70<sup>th</sup> Round, 2013.

### Cropping Pattern in Last One Year

In India it found that cereals are first choice crops among all the social groups and it can easily observe from table 6. The OBC and forward caste farmer household are showing more diversification in cropping pattern during the *Kharif* season as compared to SC and ST households. After cereals, there is variation in cultivation of crops by season. Like, pulses were ranked second during rabi season but shifted to third position during kharif season. During the *Rabi* season cropping pattern among ST farmers shows more variation compared to the *kharif* season, although cereals continued to be the dominant crop. Notably, cultivation of plantation crops is undertaken during the season and area under cultivation of plantation crops was found maximum among ST during both the seasons. Other important observation is that the production of fibres was found lowest among SC households. For comparison between SC/ST and non-SC/ST can be observed from table 6.

**Table 7: Average Expenditure and Income from Crop Farming among Social Groups in Rural India: 2013 (Rs/Hectare)**

	Input			Output (Total Income)		
	Kharif	Rabi	Annual	Kharif	Rabi	Annual
ST	9303	9970	19274	33812	32970	66782
SC	16174	23027	39201	34624	48607	83231
SC/ST	12037	16677	28714	34135	41002	75137
OBC	16337	17689	34026	41166	45429	86595
Forward Caste	21415	23027	44442	54328	53155	107483
Non-SC/ST	18287	19755	38042	46220	48419	94639
<b>Total</b>	<b>16769</b>	<b>19148</b>	<b>35916</b>	<b>43285</b>	<b>46956</b>	<b>90241</b>

Source: Authors' calculation based on SASAH, NSSO 70<sup>th</sup> Round, 2013.

## **Expenditure and Income for Crop Cultivation**

Moving on expenditure on farming in rural India, the major expenditure incurred by farmers on seeds, pesticides/insecticides, fertilizers/manure, irrigation, minor repair and maintenance of machinery and equipment, interest, lease rent for land, human and animal labour and other miscellaneous expenses; however the value here is present at aggregate level. The imputed value of family labour has not been taken into account. The average expenditure per hectare on crop farming is found Rs.35916 ranged from Rs.19274 among ST to Rs.44442 among forward caste households (Table 7). Modern inputs like purchased seeds, pesticides, fertilizer and irrigation accounted for more than half of the expenditure (about 53%) (Table not provided here). Further per hectare total expenses during *Rabi* season is observed higher compared to *Kharif* season. It was four thousand more among SC/ST and around more than one thousand among non-SC/ST.

The output value from farming can be observed from table 7. The total receipts comprise of value of output and by products. The annual total income per hectare is found least among the SC farmers (Table 7). Notably, the ST households have lower productivity of crops per hectare but as the expenditure incurred by them in crop farming is also less, in terms of the total income per hectare is found relatively high. Disaggregating season wise total income across the social group, it was lowest for SC during kharif season. But during the rabi season, it is found lowest for ST households. Interestingly, during both the season, total income was found highest among forward caste. However, total output value among OBC households remained close to SC households. For SC/ST and non-SC/ST comparison, one should follow table 7.

## **Summary**

In India, caste has been rooted in every corner of society, agriculture is not an exceptional. Different variation found across social groups in terms of agriculture production activity. This paper tries to understand caste discrimination on different agricultural activity. Using unit-level data from the Situation assessment Survey of Agriculture Household, collected by NSSO 2013, study analyses various aspect of agriculture activity such as land ownership, operational land holdings, cropping pattern and expenditure and income of household across social groups.

Study found that the percentage of households in each land-holding category declining with the increasing size of operational holding across all social groups. Around 70 percent of HH found in marginal land holdings size. Further, for ST households have more ownership holding 0.9 hectare compare to SC household. In case of SC households have lesser size of ownership holding (0.5 hectare) than their non-SC counterparts. In case of operational holdings of land of SCs comprises of 21.6 percent leased-in land, while for the rest three social groups, the percentage of leased-in land in total land possessed is less than 10 percent.



**Agriculture is the principal source of income for 71 percent of the farmers in rural India. Other than cultivation, wages/salary is major source of income among STs (24.3%) and SCs (33.5%) household. Study also found that more crop diversification among OBC farmer compare to other social group during the *Kharif* season. Further per hectare total expenses during rabi season is observed higher compared to kharif season. Finally, study revealed that total output is lowest among SC and highest among forward caste. ST and OBC households found in between.**

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## **Nesting & Foraging behaviour of *Apis dorsata* in Shevgaon**

**Makasare Sachin Petras\***

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### **Abstract :-**

**Entomology is the study of insect. It has two branches, the classical & applied entomology. The applied entomology deals with the economic importance of insects.**

**Apiology is an important branch of applied zoology that deals with the study of honey bees including bee keeping. Honey bees life revolves around the phenomenon of foraging i.e. collection of nectar, pollen & often water for their sustenance. The foraging activity automatically results in to pollination of flowers bee visit. Bees are prime pollinators among other agents of pollination. Thus bees when kept for economic consideration are also responsible for additional benefits in the form of natural increase in yield. Therefore, bees have an important role to play in promoting agro forestry & horticulture.**

**Rock bees preferably select large trees for their nesting size. They preferably construct large size comb on same place or on the single trees i.e. more than one hives are constructed on single tree or the same place. A bee is considered to be excellent bio indicator & therefore their presence in urban location indicates relatively better status of the flora & the climate. But it's strongly recommended that necessary steps need to be taken to provide appropriate habitat to the rock bees.**

### **Introduction :-**

**Honey bees are social insects, live in a colony, exhibit polymorphism & show division of labour. Their life revolves around the phenomenon of foraging for their substance thus they are prime pollinators. The pollination services by bees is advantageous in increasing crop yield & additionally obtaining the bee products namely honey, bee wax, pollen, royal jelly & bee venom. These products find usages as food, nutritive supplements, medicines & raw materials for the production of various goods.**

**Key Words:-\_Nesting & Foraging Behaviour, Pollution Affect.**

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**Taxonomic position of Rock bee :-**

<b>Phylum</b>	<b>: Arthropoda</b>
<b>Class</b>	<b>: Insecta ( Hexapoda)</b>
<b>Subclass</b>	<b>: Pterygota</b>
<b>Division</b>	<b>: Endopterygota</b>
<b>Order</b>	<b>: Hymenoptera</b>
<b>Super family</b>	<b>: Apoidea</b>
<b>Family</b>	<b>: Apidae</b>
<b>Sub family</b>	<b>: Apinae</b>
<b>Tribe</b>	<b>: Apini</b>
<b>Genus</b>	<b>: <i>Apis</i></b>
<b>Species</b>	<b>: <i>A.dorsata</i></b>

***Apis dorsata*(Rock Bee):-**

*Apis dorsata* is a honey bee of Southern & South-eastern Asia. It is only slightly smaller than the Himalayan honey bee.

In the wild, they prefer to nest in exposed areas far off the ground, on tree branches & under cliff overhangs & sometimes on buildings. They are aggressive bees which have never been domesticated. Each colony consist of single vertical comb suspended from above & the comb is typically covered by a dense mass of bees shows warning posture thus creating a visible ripple effect across the face of the comb in an almost identical manner to an audience wave at a crowded stadium.

*Apis dorsata* has a four subspecies i.e

*Apis dorsata dorsata*(primarily from India)

*Apis dorsata binghami* Cockerel (Indonesia honey)

*Apis dorsata breviligula* Maa (Philippines)

*Apis dorsata laboriosa* Fabricius (Himalayan honey bee)

**Habit & Habitat :-**

The Rock bees construct hive on the large trees, building edges, overhanging rocks, arches of bridges etc. The hives are invariably always at inaccessible location, always exposed to sunlight, large sized comb colony.

The rock bee now a day's often found in urban areas particularly overhanging the edges of huge buildings, water tanks & trees. The urban location is due to destruction of

**forests & thereby losses of habitat further urban areas often have a large variety of cultivated flora that provide avenue for foraging to the bees**

**Nesting behaviour:-**

**These bees build single large comb, exposed to day light. The comb is attached to the underside of horizontal branch of a tall tree, overhanging rocks the arches of bridges or even edges of buildings. The comb is large about 1.5- 3.0 ft long & 0.5- 2.5 ft tall in length. The worker & drone brood cells are identical in size. The comb has hexagonal cells about 18.75 cells measuring 4 linear inches. The average thickness of brood comb is 3.2 cm & surplus honey storing area may be 22.86 cm in thickness.**

**They construct hive at least at the height 8-10m. They preferably construct the comb on same place or on the single trees i.e. more than one hive is constructed on single tree or the same place.**

**Foraging behaviour:-**

**Honey bees gather pollen from flowers to use as source of protein food. Pollen grains are microscopic usually about 15-100 $\mu$  & just a pinch of pollen powder contains thousands of grains of pollen having sticky coating which help to attach them to the hairy insect. Foragers pack pollen into the boll in the pollen basket on each hind leg. These bolls of pollen are called pollen loads. On return to their hive the bee stores the pollen in the comb. Pollen is an indicator which enables researchers to study the phytogeography of plant evolution, climate, plant insect relationship & botanical, geographical origin of bee product.**

**Worker bees visit flowers & collect nectar. The mouth parts of bee form a tube which can probe into flower to reach nectaries. Nectar is sucked up, stored temporarily in gut, then taken to the hive & pass on the bee house. The bees process the nectar to form honey. Foraging requires good navigation abilities, the bee must be able to find its way back home after venturing out which may take it away from visual or auditory contact with the nest & its residents. Honey bees may forage several kilometres from their hive making them a good model species for studying navigation in central place foragers. Information used in home based navigation can be Egocentric & Geocentric. Egocentric information is generated internally by the bee & is dependent on its immediate surroundings while Geocentric information includes land marks & any maps information available to the animal. A honey bee primarily uses path integration in making their way to from foraging sites.**

The foraging process begins in a colony by scout bees being sent to such promising flower patches. Scout bees moves randomly from one flied to another during the harvesting season. A colony can extend itself over long distance up to 14 km & multiple directions simultaneously to exploit a large number of food sources. In principle flower patches with plentiful amounts of nectar or pollen that can be collected with less effort should be visited by more bees where as patches with less nectar or pollen should receive fewer bees.

Honey bees are active throughout year except during extreme winter season. In nature bee hives with rich population are observed hanging down from the branches of trees & ceiling of old & new RCC constructed houses. The worker bees communicate the information for the location of the food source through the round & tail- wagging dance. The dance information provides outgoing bees with a distance & direction to travel. Flight to be taken, flight direction is determined by sun compass orientation & distance by dance input. Once a route is learned bees incorporate visual land marks when they make repeat trips to a foraging site.

#### **Water Collection:-**

Water collection mechanisms have a specific function i.e. cooling. The bees collect drop of water from irrigated areas like water tanks, water tap and droppings of different types of cannel & stagnate water etc. and other bees place the drop of water all over the nest. They regulate & control the temperature, humidity of the hive.

#### **Swarming:-**

Rock bees migrate regularly during the year. The swarm migrate to new areas if availability of nectar & pollen sources. They also migrate when the ambient temperature drops down about 14<sup>0</sup>c & when industrial scoots flow are strong i.e. polluted climatic conditions.

Swarms emigrated leaving small white comb when the honey flow started, the colonies grew up & prepared themselves for swarming bees make queen cells hang down on the lower edges of the nest. After a swarm left a colony, the curtain became thinner & disappeared. The bees migrated when all workers emerged from the comb & new queen ability to lay eggs then them emigrated, fly around searching landing & behaving in agitated manner with the help of traces of combs, wax, propolis from previous years.

#### **Materials & Methods:-**

The paper is based on repetitive field visit making observation & collecting data on foraging & nesting behaviour. The material requisite essentially includes a digital camera, field binocular & data collection book.

The methodology includes – fortnightly visits to the various locations of the outsides of city that have rock bees hives. Once determined, the bee flora & the necessary details of flora, foraging behaviour of bees & the morphometric details of the nest were collected.

**Observation & Result:-**

**Table 1:- Bee Floral Calendar with information on pollen & nectar.**

Sr. No	Name of Species	Common name	Family	Source of N/P	Foraging Frequency		
					Morning	Afternoon	Evening
1	<i>Peltophorum pterocarpum</i> Becker	Copper Pod	Fabaceae	N/P	+++	++	++
2	<i>Azadirachata indica</i>	Neem Tree	Fabaceae	N/P	++	++	+++
3	<i>Jacaranda mimosaeifolia</i>	Nil Gulmohar	Fabaceae	P	+++	+	+
4	<i>Delonix regia Rafin</i>	Gulmohar	Fabaceae	P	+++	+++	+
5	<i>Derris indica</i>	Karanj	Fabaceae	N	++	++	++
6	<i>Acacia arabica</i>	Babhul	Leguminosae	N/P	+++	+++	+++
7	<i>Ficus religiosa</i>	Pimpal	Bignoniaceae	N/P	++	++	++
8	<i>Albizia lebeck</i>	Shirish	Bombacaceae	P	++	++	++
9	<i>Tectona grandis</i>	Teak	Verbenaceae	N/P	+++	++	++
10	<i>Moringa oleifera</i>	Drumstick Tree	Proteaceae	N/P	++	+	+
11	<i>Ficus benghalensis</i>	Vad	Moraceae	P	++	+	+
12	<i>Mangifera indica</i>	Mango	Mimosaceae	N	+++	+++	++
13	<i>Tamarindus indica</i>	Tamarind	Caesalpiniaceae	P	+++	+++	+++
14	<i>Punica granatum</i>	Dalimb	Punicaceae	P	+++	++	++
15	<i>Psidium guajava</i>	Guava	Myrtaceae	N/P	+++	+++	++
16	<i>Embllica officinalis</i>	Avala	Bromeliaceae	P	++	++	++
17	<i>Achras sapota</i>	Chiku	Fabaceae	N/P	+++	++	++
18	<i>Annona squamosa</i>	Custard Apple	Fabaceae	P	+++	++	++
19	<i>Feronia limonia swingle</i>	Wood Apple	Rutaceae	N/P	++	++	++
20	<i>Carica papaya</i>	Papaya	Caricaceae	N	+++	++	++
21	<i>Michelia champaca</i>	Sonchampa	Meagnoliacea	P	+++	++	++
22	<i>Catharanthus roseus</i>	Sadafuli	Apocynaceae	N	+++	+++	+++
23	<i>Nyctanthes arbortristis</i>	Parijatak	Verbenaceae	P	-	++	+++
24	<i>Caesalpinia pulcherrima</i>	Shankasur	Fabaceae	P	+++	+++	++
25	<i>Jasminum grandiflorum</i>	Chameli	Oleaceae	N/P	+++	++	+++
26	<i>Canna indica</i>	Kardal	Cannaceae	P	++	++	++
27	<i>Ricinis communis</i>	Erandel	Euphorbiaceae	N/P	++	+	++
28	<i>Cestrum nocturnum</i>	Raatrani	Solanaceae	N/P	-	++	+++
29	<i>Cocos nucifera</i>	Coconut Tree	Arecaceae	N/P	+++	+++	+++
30	<i>Thespesia populnea</i>	Ranbhendi	Caesalpiniacene	P	++	++	++

31	<i>Leucaena leucocephala</i>	Subabhul	Mimosaceae	N	++	+	+
32	<i>Millingtonia hortensis</i>	Buchache zad	Bignoniaceae	P	++	+	+

N.B

Heavy Foraging Visits + + +

Moderate Foraging Visits + +

Minimal Foraging Visits +

**Table 2:- *A.Dorsata* colonies include location & dimension of the nest.**

Sr. No	Location (Shevgaon outside area up to 15km)	No. of colonies in different location	Nest size (Approx.)	Height from ground level (Approx.)
1	Shevgaon	1	70x20	22
	-	1	70x25	26
	Ghotan	1	68x23S	24
2	Shevgaon	1	60x29	26
	-	1	73x30	25
	Bodhegaon	1	70x27	22
3	Shevgaon	1	65x20	21
	-	1	68x22	22
	Kukana	2	70x20,70x25	25
4	Shevgaon	2	67x22,70x27	26
	-	1	80x25	28
	Amarapur	2	75x27,70x25	25
5	Shevgaon	1	70x20	22
	-	3	75x27,70x25,68x23	24
	Samangaon	2	80x26,70x10	23

#### Conclusion:-

Less number of colonies in industrial area is surprise element in observation. This essentially indicates the presences of green zone but pollution influencing the bee's thereby inappropriate habitat for the bees. Interestingly green zone & water irrigated area have more number of colonies, to be specific – 5 colonies in small area. This perhaps is because of the avenue tree plantation & green zones provide the forage. The pollution in industrial areas does not seem to be influencing the bees much; this indicates the levels of pollution are tolerable. The number of colonies under normal circumstances should have been at least 5 times more. This could be a positive indication of the right kind of vegetation flourishing in the area. The planting of bee



**flora therefore should be encouraged & efforts need to be taken to protect the colonies from barbarian ways of harvesting.**

**It is strongly recommended that necessary steps need to be taken to provide appropriate habitat to the rock bees. A large number of bee colonies ultimately indicate positive signals to the wild flora & crop lands around the city. All efforts need to be taken to encourage *A.dorsata* colonies around the city.**

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## **Sugar Industry Effects on O<sub>3</sub> Air Pollution on Crop Yield in Pathardi Tehashil**

Ravindra R. Shirsat\*

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### **Abstract:-**

Effects of Sugar Industry and O<sub>3</sub> air pollution on crop yield in Pathardi Tahasil was studied. Measurement of surface ozone (O<sub>3</sub>) mixing ratio was made from January 2017 to December 2017 in Pathardi tahasil (19.17°N, 75.18°E, 1748 feet above sea level), India. The monthly average of daytime maximum of O<sub>3</sub> mixing ratio ranged from 20 to 63 parts per billion by volume (ppbv) with an annual average of about 27 ppbv. The estimated winter wheat and summer crop yield reduction by 10% and 16%, respectively from present O<sub>3</sub> pollution level associated with AOT40 (accumulation exposure of O<sub>3</sub> concentration over a threshold of 51 ppbv) index values 7480–8156 ppbv h in Pathardi tahasil.

**Keywords:;** Diurnal variation, meteorological conditions, Ozone depletion.

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### **1. Introduction**

Air pollution and climate change have been shown to represent major problems to global food security[1]. Air pollutants like surface ozone that badly affects human health, animal health and agriculture crops yield. The studies have shown the reduction of crop yield [2]. The SUM06 is the sum of the hourly O<sub>3</sub> mixing ratios over 70 ppbv over the growing season and during daylight hours. The AOT40 index is the sum of the amounts by which hourly O<sub>3</sub> mixing ratios exceed a threshold of 63 ppbv over the growing season and during daylight hours. The SUM06 and AOT40 index have commonly been used to estimate crop loss due to O<sub>3</sub> in Europe and USA, respectively. These studies have revealed that the AOT40 value is above the critical level (3000 ppbv h) for daylight over 3 months period during growing to harvesting season of crop. In India, a few O<sub>3</sub> measurements studies have been reported[3]. They have shown that high O<sub>3</sub> mixing ratio between 43 and 163 ppbv during winter and summer season in urban areas.

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**In this study, we report diurnal and seasonal variation of O<sub>3</sub> measured at Pathardi tahasil in the light of meteorological conditions. Herein Preliminary assessment of the effects of O<sub>3</sub> pollution on winter wheat and summer crops yield reduction associated with AOT40 index is reported[4].**

## **2. Ozone Balance**

**The balance of ozone is determined by the amounts of reactive gases and how the rate or effectiveness of the various reactions varies with sunlight intensity and duration, location in the atmosphere, rainfall, humidity, temperature, and other factors. Ozone abundances in the stratosphere and troposphere are determined by the balance between chemical processes that produce and destroy ozone. As atmospheric conditions change to favor ozone-producing reactions in a certain location, ozone abundances increase. Similarly, if conditions change to favor other reactions that destroy ozone, abundances decrease. The balance of production and loss reactions combined with atmospheric air motions determines the global distribution of ozone on timescales of days to many months. Global ozone has decreased during the past several decades because the amounts of reactive gases containing chlorine and bromine have increased in the stratosphere due to human activities like industrialization .**

## **3. Location and Measurements**

**Fig. 1 represents a map of Ahmednagar district with the measuring site-Pathardi tahasil are mentioned in the present study. Pathardi tahasil is surrounded by four sugar industries namely Shri Vridheshwar Sahakari sugar factory, Kedareshwar sahakari sugar factory, Dnyaneshwar sahakari sugar factory, and each are at nearly distance of 15-25 km from measurement site and Jayakwadi dam is located on north side.**



**The sampling site of O<sub>3</sub> is surrounded by cultivated field and some small and big trees. There are major emission sources of air pollution in the vicinity of sampling site, Present population of Pathardi is about 0.21millions as per 2011 India census and vehicular population nearly 0.015 millions. Ahmednagar and Beed are the nearest metropolitan urban city located at about 50 and 70 km in the Northwest and East direction.**

Months	O <sub>3</sub> (ppbv)	Max.air temperature ( <sup>0</sup> C)	Max.RH (%)	cloud cover (%)
January	23.4	20.4	60	33
February	22.8	30.8	55	29
March	24.9	33.8	42	36
April	29.5	38.8	36	28
May	30.8	22.6	49	56
June	13.2	32.6	53	62
July	12.3	28.9	69	84
August	14.2	31.7	80	35
September	15.2	24.9	84	69
October	18.2	33.5	65	48
November	22.6	40.2	62	59
December	23.4	28.3	61	26

Table. Monthly average ozone, maximum air temperature (<sup>0</sup>C), maximum relative humidity (RH), and cloud cover (cc) observed at Pathardi.

#### 4.0. Results and Discussion:

##### Diurnal variation

Table is the comparison of annual average diurnal variations of O<sub>3</sub> mixing ratio observed in 2017. Annual diurnal average of O<sub>3</sub> was computed for fixed hours from January to December. In May, the highest of O<sub>3</sub> was observed. It is seen from figure that the O<sub>3</sub> mixing ratio starts increasing after sunrise in the morning, goes to maximum during daytime due to photochemical production and then again decreases during night time. The corresponding minimum of O<sub>3</sub> mixing ratio 8.4 ppbv was observed at about 07:00 h in the morning. The O<sub>3</sub> reaches to maximum value at afternoon due to large photochemical reaction. During nighttime, production of O<sub>3</sub> ceases due to lack of sunlight and hence O<sub>3</sub> decreases throughout the nighttime by chemical loss of O<sub>3</sub> with and to a lesser extent with nitrate radical (NO<sub>3</sub>), and dry deposition at the surface.

Table shows the comparison of average monthly diurnal variation of O<sub>3</sub> in April 2016. The production of O<sub>3</sub> was more in April during the summer season because of highest ambient temperatures, more intense and, less cloudy and longer (>14 h) duration of

day, which enhanced the photochemistry resulting high mixing ratio of O<sub>3</sub>. It is seen from the Fig. 1 that the maximum of O<sub>3</sub> mixing ratio was about 30.8 ppbv around 16:00 h at noon and minimum about 8.4 ppbv at 07:00 h in the morning indicating that the O<sub>3</sub> mixing ratio was highest during daytime and also in the night time in May 2017. The highest O<sub>3</sub> peak in May 2017 was due to favorable temperature. The hot temperature in May mean that the chemical reactions proceed at a faster rate and O<sub>3</sub> production was close to its greatest. On the contrary, RF and overcast sky conditions was persist in May 2017. In other study it is reported similar diurnal cycle of O<sub>3</sub> at rural site as observed in the present study. Further, the latitude of Pathardi (19.17°N) station lies in the tropics. Hence, stratospheric ozone intrusion in the troposphere at the ground-level is also ruled out. Therefore, high O<sub>3</sub> during summer is only due to both local photochemical production of O<sub>3</sub> and transport of O<sub>3</sub> from upwind northeast and northwest cities.

#### 5. Conclusions:

Effects of Sugar Industry and O<sub>3</sub> air pollution on crop yield in Pathardi Tahasil were studied. Measurement of surface ozone (O<sub>3</sub>) mixing ratio was made from January 2017 to December 2017. The monthly average of daytime maximum of O<sub>3</sub> mixing ratio ranged from 8.6 to 31.7 parts per billion by volume (ppbv) with an annual average of about 24 ppbv. The estimated winter wheat and summer crop yield reduction by 10% and 16%, respectively from present O<sub>3</sub> pollution level associated with AOT40 (accumulation exposure of O<sub>3</sub> concentration over a threshold of 40 ppbv) index values 6771–8928 ppbv. Therefore Sugar industries in Shevgaon tehashil is found very adverse effect on crop yield.

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## **Conyza Bonariens(L.) Less.Var.Cronq. (=Erigeron linifolius willd.) an Antifungal Weed Species of Asteraceae Family**

Dahatonde P.A.\*; Belhekar.S.T.\*\*;Kadlag.S.D\*\*\*

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### **Abstract**

Allelochemicals are the natural secondary metabolites produced by the plants .Plants contain varieties of chemicals that are produced as secondary metabolites. They are natural and easily biodegraded. Botanical biocides are eco-friendly i.e. bio-degradable, renewable and abundantly available, there is vast scope for research in Allelopathy and investigating allelochemicals and use them as biocides in sustainable agriculture for food production without polluting environment.

**Key Words :**Conyza binaries(L.)Less.var.Erigeron linifolius,weed,antifungal.

### **Introduction**

Allelopathy ,a current area of research ,which may be useful in agriculture to control fungal and bacterial disease of crops, increase yield, minimize some problems related to multiple cropping systems, soil productivity and availability of soil. Since botanical source of eco-friendly i.e. biodegradable, renewable and abundantly available, there is a vast scope for research in Allelopathy and investigating allelochemicals and use them in agriculture to sustain food production without polluting environment. Allelochemicals are the natural secondary metabolites produced by the plants . Molisch(1937),a plant physiologist and the father of Allelopathy introduced the word “Allelopathy” for beneficial as well as harmful (detrimental) reciprocal biochemical interactions among plants including microorganisms. The word ‘Allelopathy’ proposed by Molish(19937) is derived from two Greek word: ‘allelon’ means reciprocal, mutual, among each other, and ‘pathos’ means grief, sorrow or that happens to one. He defined Allelopathy as any direct or indirect harmful effect by one plant on another through production of chemicals compounds that escape into the environment. Allelopathy research will establish a boon in agriculture and forestry production (Narwal,1994). Plants contain varieties of chemicals that are produced as secondary metabolites. They are natural and easily biodegraded. Researchers of all over the world have been exploring plant species from their allelopathic potentials so that natural, eco-friendly and biodegradable biocides could be developed. Allelopathy, originally defined as “Chemically elicited interactions among plants mediated by varieties of chemical compound with different of modes of biochemical actions. Allelopathy is multidisciplinary science where ecologist, chemists, physiologist and molecular biologist could contribute their skills. As a result of these studies development of new agro-chemicals, cultural methods for developing allelopathics crops with increasing weed resistance is possible. Since ancient times human societies all over the world have been using plant resources for fulfilling their basic needs like food, medicine etc. With the increase in human population demand for basics needs went on increasing.

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To meet the demands agricultural techniques, synthetics toxic biocides viz. nematicides, weedicides, herbicides, fungicides and insecticides and synthetics fertilizers have been used to increase the agricultural yields. Indiscriminate use of these and water developed severe environmental problems like water and soil water pollution. Our fertile lands are becoming non-fertile day-by-day. Increasing global awareness towards environmental pollution problems due to synthetic agrochemicals, has led researchers to find out safe alternatives.

Botanical biocides are eco-friendly i.e. biodegradable, renewable and abundantly available, there is a vast scope for research in Allelopathy and investing allelochemicals and use them in sustainable agriculture for food production without polluting environment. Allelochemicals are the natural secondary metabolites produced by the plants. The present paper will focus on the aspects of Allelopathic potentials of common weed *Conyza bonariensis*(L.) Cronq.(=*Erigeron linifolius* Willd.) of Asteraceae family as fungicide.

#### REVIEW OF LITERATURE

Categories of fungicidal and antimicrobial allelopathic compounds produced as secondary metabolites (Rice, 1984) by plants are.

**Long-chain fatty acids and Polyacetylenes:** Polyacetylenes are largely found on the plants of Asteraceae family, for example,  $\alpha$ -terthienyl in *Tagetes erecta* L., phenylheptatriene in *Bidens pilosa* auct. non. L., safynol and dehydrosafynol in *Carthamus tinctorius* L., etc are antimicrobial.

Podolska et al., (2003). Roots of alfalfa (*Medicago sativa* L.) contain saponins and can be sprayed as safe fungicide as well as pesticides.

Martyniuk et al. (2004) recorded that the saponins extracted from aerial plants of four *Medicago* L. species significantly inhibited the mycelial growth of soil borne fungus *Cephalosporium gramineum* Nisikado et Ikata.

Chuihua et al. (2004) found out that *Ageratum conyzoides* L., a member of Asteraceae family contains allelopathins like 3-caryophyllene, p-bisabolene and p-farnesene that could exert synergistic inhibitory effect on test plants. It is herbicidal as well as fungicidal.

Kaushik et al. (2004) recorded that the leaf extract of 'Nirgudi' (*Vitex negundo* L., family Verbenaceae) contain chemicals like n-pentatriacontane, p-hydroxybenzoic and 5-hydroxyisophthalic acids which are antagonistic to fungal pathogens like *Rhizoctonia solani* Kuhn. And bacteria.

Wang et al. (2005) found out that like the root extracts of 'Brinjal' (*Solanum melanogena* L., family Solanaceae) couldn't exert allelopathic effects on *Verticillium* wilt.

#### MATERIAL AND METHOD

**Study area:** Ahmednagar district is the largest district of Maharashtra state. It is located between 18°2' and 75°5' North latitude and 70°9' and 75°5' East longitude. It occupies an area of 17.035 sq. km. Sahyadri ranges are present on the northeast part of the district. This is a region where forest is situated. The Sahyadri has formed a natural boundary in between Ahmednagar, Thane and Nashik District. Balaghat is the prominent range of Sahyadri that traverses the district.



**Conyza bonariens (L.) Cronq.** is a species of Asteraceae family, native of Europe. It occurs throughout the tropical and subtropical belt of the World. The native ranges include Tropical America, Venezuela and Colombia to Peru, and Bolivia (Wagner et al,1999). It is also found in Ahmednagar, Auranagabad, Nanded and Parbhani districts of Maharashtra state India. Its wide distribution and importance as weed is due to abundant seed production.

**Conyza bonariens (L.)** is a perennial herb and is frequently found in crops fields, roadsides, fallow lands and waste areas and occasionally in lawns and nurseries. Plant was identified with the help Flora of Maharashtra (Almedia,2001)

**Classification (as per Bentham and Hooker's system):**

**Botanical name: Conyza bonariens (L.) Cronq. (= Erigeron linifolius Wild.)**

**Kingdom: Plantae**

**Order: Asterales**

**Family: Asteraceae (Compositae)**

**Genus: Conyza**

**Species: bonariensis(L.) conq.**

Erect pubescent herbs, 40-60 cm tall; stem striate, branched near apex; Leaves are closely set on the stem, sessile, linear or oblanceolate, 10-45cm long, entire or obscurely lobed in the upper part; Heads 8-10 mm across, 1 to 5 in racemose panicles, peduncles slender, glabrous receptacle, involucre bracts many seriate, linear, green, with scarious margins, 3-6 mm long, hairy, marginal florets many with filiform, obscurely 2-3 fid, dull white corollas, central florets tubular, 5 lobed, dull white, corolla 5mm in length; ovary is oblong, pubescent, styles smooth; stigmas papillate; fruits achene, oblong, 5 angled, compressed with nerved margin, sparsely hairy, Pappus bristles scabrid and is as long as the corolla.

**Flowering and Fruiting period: November to February**

**Aspergillus niger van Tiegh:** It belongs to class Ascomyetae, order Aspergillales and family Aspergillaceae. It is popularly known as black mould. It is a saprophytic fungus which is widely distributed (cosmopolitan) and occurs as one of the most frequent contaminant of stored food, agricultural produce (figs, dates, nuts), jams and jellies, rice, bread and other food stuffs, cellulose materials. It also grows as animal and bird parasite.

#### **EXTRACT BIOASSAY**

Bioassay experiments at room temp (25 to 28<sup>0</sup>) were performed in the recognized Research laboratory of Botany Department, New Art's Commerce and Science College, Ahmednagar (Maharashtra) during the year 2016-2018.

Plants were collected from waste places around the college campus. Stock solutions of the fresh leaf samples were prepared. Extract was obtained by crushing leaves in a mortar and pestle using distilled water in ratio of 1:10 w/v, 1:w/v and 1:30w/v (leaves:distilled water in ) to obtain stock solutions of 10%, 20%, 30% concentration.

**Preparation of PDA medium:** 200 g peeled pieces of potato tubers (*Solanum tuberosum*) were boiled in distilled and filtered through muslin cloth in 100 ml conical flask. 15g dextrose was added in it and then 15g agar was added slowly while stirring it. Final

volume 1000ml was made. This PDA medium was then autoclaved and used for culturing fungi in sterile petridishes.

*Aspergillus niger* produced from the Departmental laboratory was inoculated in agar medium under sterile conditions.

Petridishes of 11cm diameter containing freshly prepared PDA medium were used and allowed the fungus to grow. Many such plates were prepared. With the help of cork borer four wells per petriplate were prepared. Leaf extracts of 10,20, and 30% concentration were added separately. In control plates sterile distilled water was added in the wells. Six replicates of each other treatments were maintained.

Extracts inhibited the fungus around the wells. Inhibition zones around wells were measured randomly by taking at least 24 readings per treatments. Results obtained (means) were analyzed by single factor ANOVA multiple range test using Microsoft Excel programme. The method in brief is given below:

Data (24 observations per treatment) were entered in the columns in worksheet. Clicked on 'Data' and then on 'Data analysis. Clicked on 'ANOVA single factor' and then 'ok'. ANOVA single factor dialogue box is displayed. Input and output ranges were added. Clicked on 'option' button of column (because data is entered in columns). Typed alpha/P-value 0.05 and click on 'OK'. Computer analyses data of the four columns (all means) and displays table that includes sum, average, variance of each column, MS between and within groups and p-value.

If P-value is equal or smaller than alpha (0.05) the null hypothesis is rejected. i.e. No difference in the means is rejected meaning there is difference in the 'mean' figure i.e. the means of four columns are significantly different from each other. Such means denoted by different alphabets a, b, c and d in the observation tables.

If P-value is more than alpha (0.05) value null hypothesis is accepted meaning all mean values of four columns are not significantly different from each other. Such values are denoted by same letter 'a' meaning all mean values are not much different from each other i.e. more or less similar. To find out significant difference in between pairs of means, calculation of CD at 0.05% level followed by Tukeys HSD i.e. Honest Significant Difference Test was used.

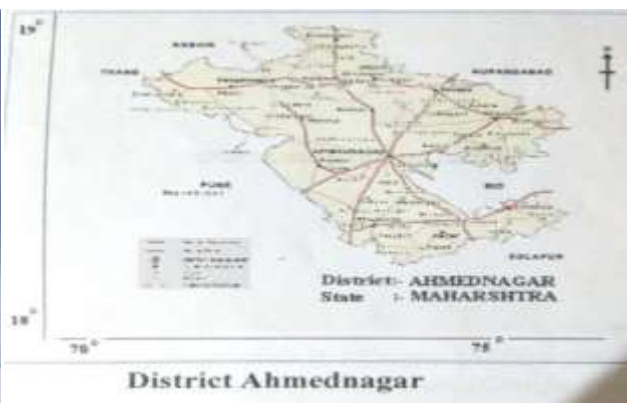
Calculation of CD (critical difference): From summary table of single factor ANOVA, critical difference in between pairs of means is calculated by using following formula:

$CD = q \cdot \sqrt{\text{estimated variance within groups}/n}$  (Where q i.e. 3.68 is the value from the studentized range (Table NO7 from statistics book), n= df within groups)

Tukeys HSD (Honestly significant Difference) test : The formula is:  $qs = (Y_A - Y_B) / SE$  (Where  $Y_A$  is the larger of the two means being compared and  $Y_B$  is the smaller, of the two mean beings compared, SE=standard error of the data in question )



Photographs were taken by using digital camera:



*Conyza bonariensis* (L.) Cronq. (= *Erigeron bonariensis*) Family Asteraceae (Compositae)



Extract Preparation



Effect of aqueous leaf extract & methanolic leaf Extract of *Conyza bonariensis*(L.) Cronq. On growth of *Aspergillus niger* van Tiegh

**OBSERVATION AND RESULT**

Effect of aqueous and methanolic extract of *Conyza bonariensis*(L.) Cronq.(=*Erigeron linifolius* Willd.) on mycelial growth of *Aspergillus niger* vanTiegh:

(Refer table on No.1,graph 1(A) and 19b0, Plates V and VI) In the present work it was found out that the fresh leaf extracts of *Conyza bonariensis* (L.) Cronq. (=Epigeron linifolius Willd).of various concentrations inhibited mycelia growth of the fungus *Aspergillus niger* Van Tiegh,around the wells prepared in the agar plates. The inhibition goes on increasing with increase in leaf extracts concentrations. The inhibitory zones were measured. About 24 readings were taken randomly and entered in MS Excel worksheet.Statistical analysis (refer Plate IV) revealed following things:

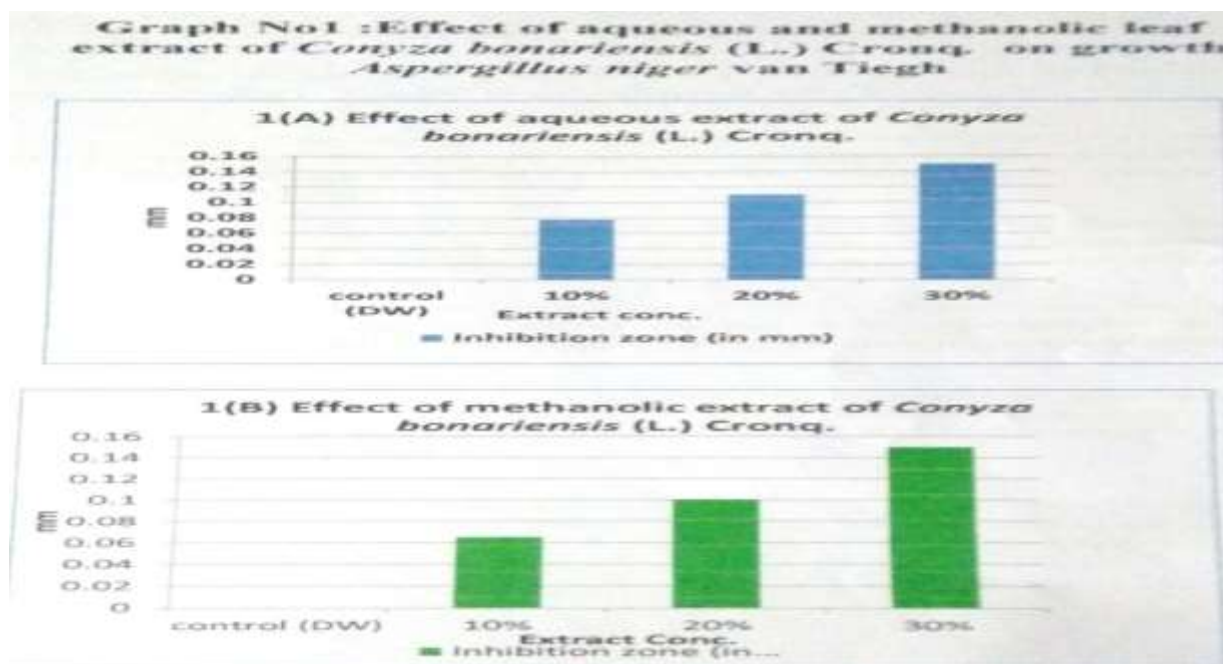
1. P-value is less than 0.05% alpha value (taken during single factor ANOVA analysis.) This indicated all means (of extract conc. Treatment)are significantly different from each other.
2. CD values at 0.05% level are 0.025 and 0.027. CD at 0.05% is < diff. in means indicating all means are significantly different.
3. F value is more than F critical value (refer plate no IV) indicating all means are significantly different from each other.
4. Tukeys HSD test (q value) was performed to find out any similarity in the means obtained . q value calculated were more than q critical value (3.68 from table No 7, where df:96,treatments:4). It also indicated that all means were statistically significantly different from each other.

Aqueous and methanolic extracts of *Conyza bonariensis* (L.) Cronq. More or less inhibited mycelial growth of *Aspergillus niger* Van Tiegh.

**PHOTO: Result Table no-1(A) and Plate V and VI**

Sr No	Extract	conc	Inhibition zone (in mm)	P-value at 0.05%	CD at 0.05%	F value	F crit value	Tukeys test
1	Aqueous	control (DW)	0.00a ±0.00	8.126E-11	0.025	21.71	2.76	Q values
		10%	0.078b ±0.007					More than q critical
		20%	0.11c ±0.019					Value 3.68
		30%	0.15d ±0.017					Hence significantly different
2	Methanolic	control (DW)	0.00a ±0.00	1.35E-10	0.027	21.14	2.70	Q values
		10%	0.065b ±0.01					More than q critical
		20%	0.10c ±0.011					Value 3.68
		30%	0.15d ±0.024					Hence significantly different





### Summary and Conclusion

*Conyza bonariensis* (L.) Cronq. (=Erigeron linifolius Willd.) of Asteraceae family is common weed. In the present work it was found out that the fresh leaf extract of *Conyza* of various concentrations inhibited significantly mycelia growth of common saprophytic fungus *Aspergillus niger* Van Tiegh. The inhibition goes on increasing with increase in leaf extract concentrations. It proves to have a fungicidal potential. It can be further used to find out its fungicidal potential against fungi that cause crop plant diseases. There are abundant species of Asteraceae family that could be tried to find out effect on not only saprophytic but phytophagogenic fungi that cause fungal diseases on agricultural crop plants. Instead of using non-biodegradable synthetic agrochemicals to control fungal diseases of crops that also cause severe pollution why not to use plant originated biodegradable fungicides to control diseases of crop plants?

Efforts are to be done to work out fungicidal properties of plant species of Asteraceae and other families of flowering plants. There is a wide scope for this type of work. Allelochemicals could be isolated and use in agriculture.

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## Description Of Cestode Parasite *Circumoncobothrium Dnyaneshwarinae* In Fresh Water Fish *Clarius Batrachus* From Pravara River.

Naik V.P. & Tambe D. S.

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### ABSTRACT

The present paper deals with Redescription of cestode parasite *Circumoncobothrium dnyaneshwarinae* in Fresh water fish *Clarius batrachus* from Pravara river. Cestodes were collected in June 2017 to Dec.2017.this cestode same in many characters having Scolex large oval, rostellum oval and transversely placed, rostellar hooks are 67(65-70) in numbers, neck absent. Mature proglottids are four times broader than longer, testes are medium oval shaped 82 (80-85)in number, cirrus is thin coiled, ovary bilobed Dumbbell shaped, ovarian lobes with 3-6 acini, vitellaria are granular 2 row on each lateral side. But it differs in gravid segment are two broader than long, eggs are oval, thin shelled.

**Key words:** - *Clarius batrachus*, *Circumoncobothrium*, Cestode.

### INTRODUCTION

The genus, *Circumoncobothrium* is erected by Shinde G.B., 1968 from the intestine of freshwater fish as *C. ophiocephali* from *Ophiocephalus leucopunctatus* as a type species *C ophiocephali*. Chincholkar, 1976 described two new species of the genus as *C. shindei* from a fresh water fish, *Mastacembellus armatus* and *C. bagariusi* from *Bagarius*.

In 1977, Shinde added a new sp. *C. khami* from *Ophiocephalus striatus*. Later on Jadhav and Shinde, 1976 added two new species, under the genus viz. *C. aurangabadensis* and *C. raoii* from *Mastacembellus armatus*. Jadhav and Shinde, 1980 described *C.gachuai* from *Ophiocephalus gachua*. Jadhav et al., 1990 described *C. yamaguti* from *Mastacembellus armatus* later on Shinde et al., 1994 added *C.alii* from *Mastacembellus armatus*. Patil et al., 1998 described *C. vadgaonensis* from *Mastacembellus armatus*. Later on another nine species are added to this genus.

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For taxonomical study Cestode parasites were collected from Pravara river in Ahmednagar District, Maharashtra. The fish Species *Claries batrachus* selected for study because in carnivorous fishes more possibility for infection than herbivores fishes. However these edible fishes are known to harbor a number of parasites which cause deterioration of their health and affect their market value by the parasitization. Fish is correctly regarded as a healthy component of the diet; it is an excellent source of protein and is low in saturated fats. There are risks associated with eating cultured fish owing to the infection by helminth parasites.

The present communication deals with the description, of one redescribed species as *C. dnyaneshwarinae* from *Clarias batrachus*.

#### MATERIAL AND METHODS

For the taxonomical study of Cestode parasites, the fishes were collected in Pravara river Ahmednagar District, Maharashtra. The alimentary canal of the fishes were removed and cut open in normal saline water in Petri-dish. The alimentary canals observe under binocular microscope (recorded infected and non infected hosts) the collected worms were washed in distilled water to render them free from intestinal contents. The Cestode was preserved in 4% formalin. Borax carmine and Haematoxylin stain were used for staining of parasites. The worms were passed through various alcoholic grades i.e. 30 %, 50 %, 70 %, 90 % and 100 % cleared in xylen and mounted in DPX. All the drawing was made with the aid of camera Lucida. All measurements are in millimeters, unless otherwise indicated.

Out of Two hundred Eighty eight intestines, one hundred thirty two intestines were infected in freshwater fish, *Clarias batrachus* (Linnaeus, 1758) from Pravara river, Dist. Ahmednagar (M.S.) India during June 2017 to Dec.2017.

#### RESULT AND DISCUSSION

The scolex large oval, bears the rostellum its anterior end, which is medium in size, oval shape, transversely elongated, having constriction at the middle and measures 0.145(0.128- 0.163) in length and 0.160(0.144- 0.194) in width. The rostellar hooks are 67(65-70) in number, which are long, stout, rod shaped pointed at upper end, longer hooks present in the centre of the quadrant and later on decreases in length on both the sides. The hooks measures 0.051(0.038-0.065) in length and 0.005(0.003-0.007) in width. Neck absent.

The mature proglottids are broader than long, nearly four times broader than long with measure 0.333(0.270-0.397) in length and 1.148(1.077-1.522) in breadth.

The testes are medium in size, oval in shape, 82 (80 -85) in number, arranged in a single field or either lateral sides of ovary.

The cirrus pouch is small in size, oval in shape transversely placed measures 0.111(0.095-0.126) in length and 0.053(0.026-0.074) in breadth. The cirrus is thin, coiled, obliquely placed, contained within the cirrus. The vas deferens is short, thin, extends obliquely. The ovary is medium in size, distinctly Bilobed slightly dumb-bell shaped in appearance, transversely placed, in the middle of the segments and measure 0.169 (0.124-0.214) in length and 0.657 (0.390-0.928) in breadth. The isthmus is connecting the two ovarian lobes, straight, even in width, transversely placed, consisting 3-6 acini and measure 0.115 (0.095-0.136) in length and 0.035(0.034-0.038) in breadth. The vagina is thin, short, arises from the genital pore, slightly curved and opens into the ootype and measure 0.066 (0.053-0.076) in length 0.006 (0.003-0.012) in width. The ootype is medium in size, rounded in shape. The genital pore is small in size, oval in shape, preovarian, and measures. Longitudinal excretory canals are not distinct.

The vitellaria are granular, small in size, round in shape, in 2 rows, on each lateral side, extending from the anterior to the posterior margin of segments.

Gravid segment are three times broader than longer measure 0.602 in length and 2.203 in breadth. Uterus which is sac like oval structure measuring 0.998 in length and 0.227 in breadth. The eggs are oval to elongated, thin-shelled measuring 0.043 in length and in width.

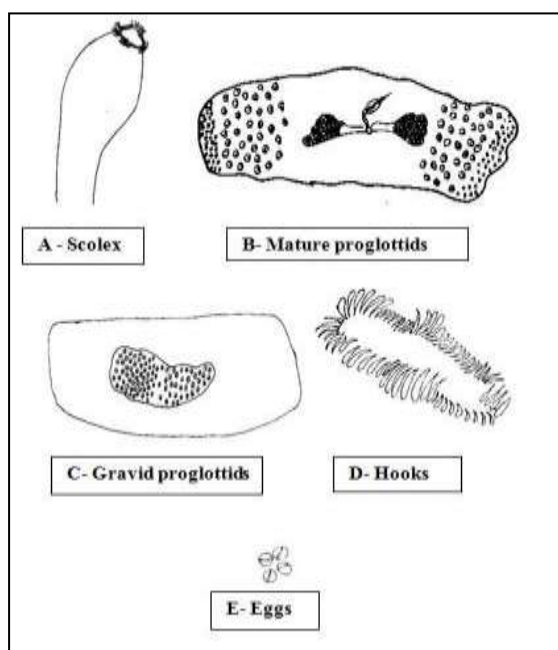


Fig . 1. *Circumoncobothrium dnyaneshwarinae* r.d.

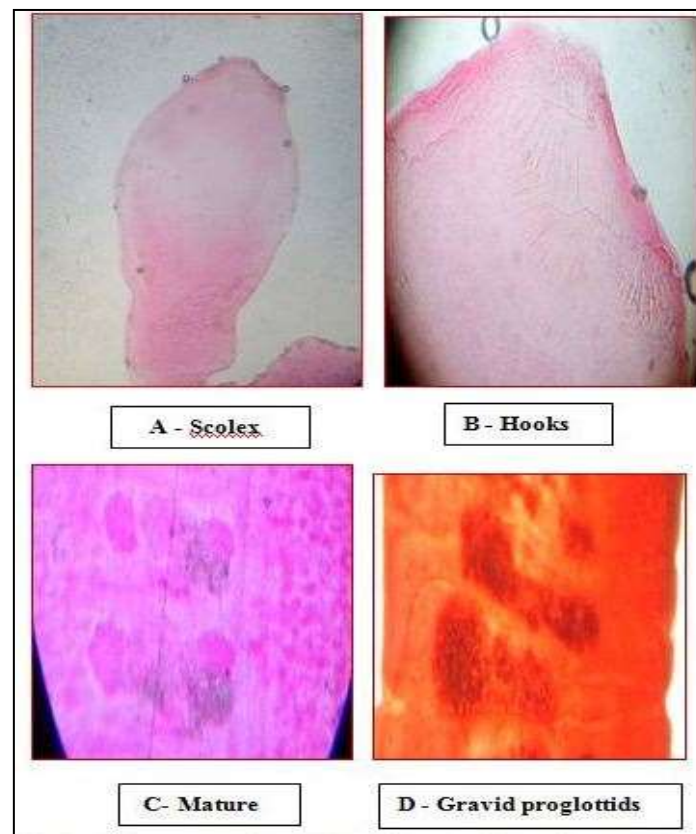


Fig . 2. *Circumoncobothrium dnyaneshwarinae* r.d.

## CONCLUSION

The present taxonomical study revealed that freshwater fish, *Clarias batrachus* (Linnaeus, 1758) is infected by the new species of genus *Circumoncobothrium* in study area. On the bases of known specimens of genus *Circumoncobothrium*, the new species is *Circumoncobothrium dnyaneshwarinae* and it is present in the intestine of host.

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## **Soil Analysis From Near The Lake Of Kapurwadi**

**Miss.Waghmare Rupali Sahebrao**

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### **Abstract:**

Soil is mixture of organic matter, minerals, gas, liquids, and organisms that together support life. The earth body of soil is the pedosphere. which has four important functions: it is a means of water storage, supply and purification; it is modifier of earth's atmosphere; it is habitat for organism; all of which in turn, modify the soil. In the present study indicates the physiochemical properties of soil. The soil sample is collected from near the kapurvadi lake which is located in Ahmednagar district of Maharashtra. The area selected near the lake because of the lake has 8 months water availability. The purpose of this study is to identify the characters of soil by using different parameter and analyzed the soil, the colour, texture, temperature, moisture, percentage water holding capacity, electrical conductivity, pH, organic carbon.etc. & to help the farmers of that area .From this study we can conclude that the characters of given soil sample are good & it is suitable for the cultivation of crops, vegetables, especially cash crops.

**Keywords:** Ph, electrical conductivity, organic carbon, pedosphere,

### **Introduction**

The soil is developed by the weathering of rocks present in nature & differentiated into horizons of various heights & characters. The soil is always different from its parent material as the morphological, chemical & biological characters are concerned.

The soil is natural medium for plant growth and supplies the required nutrients to the growing plants some soil are more productive those contain adequate amount of all essentials elements in the form readily available to plants. For good plant growth the soil should also be in good physical condition which ensures proper supply of air & water.

The soil consists of five major component: mineral matter, organic matter, air water & microorganism. Mineral matter forms the bulk of soil (more than 90% by weight ) Almost all the element found on the earth present in the soil, however, most of them occur in trace quantities.

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**Soil of moderate texture is supposed to be very good for the growth of plants, as they supply moderate quantities of nutrients, air & water to the plants. The soil productive capacity, in most cases, can be evaluated satisfactorily by determining chemical, physical & microbiological properties of soil. Oil sampling is perhaps the most vital step for any soil analysis. As a very small fraction of the huge soil mass is used for analysis, it becomes extremely important to get a truly representative soil sample of the field. Soil test based nutrient management has emerged as a key issue in efforts to increase agricultural productivity and production since optimal use of nutrients, based on soil analysis can improve crop productivity and minimize wastage of these nutrients, thus minimizing impact on environmental leading to bias through optimal production. Deficiencies of primary, secondary and micronutrients have been observed in intensive cultivated areas.[1]**

**The present soil sample is collected from near the lake of kapurwadi located in Ahmednagar District. The study soil from this area was done by using different parameters**

#### **MATERIAL & METHODS**

**The presented soil sample were collected in the depth of 0-20 cm from the surface of the soil from the area near the kapurwadi talav. Samples collected were thoroughly mixed on a piece of clean cloth, air dried and the lumps were broken using wooden pestle and mortar (Tandon. 1993). Particles were disaggregated, crushed. The soil sample were preserved in polythene bags for further analysis. The chemicals & reagents used for analysis were of A.R. grade from S.D.Fine Merck standard instrumental & non instrumental method are used for estimation of the mentioned parameter.**

<b>Sr. No.</b>	<b>Soil Parameter</b>	<b>Result</b>
<b>01</b>	<b>Soil Colour</b>	<b>Black</b>
<b>02</b>	<b>Soil Texture</b>	<b>Clay and Loamy</b>
<b>03</b>	<b>Temperature</b>	<b>20 °C</b>
<b>04</b>	<b>Moisture Percentage</b>	<b>47.05%</b>
<b>05</b>	<b>Water Holding Capacity</b>	<b>65.70%</b>
<b>06</b>	<b>Conductivity</b>	<b>0.35 at 25 °C</b>
<b>07</b>	<b>pH</b>	<b>6.94</b>
<b>08</b>	<b>Organic Carbon</b>	<b>0.52%</b>

Soil has various colours because of its chemical properties. The colour studied soil sample is determined by spreading a soil uniformly over a petriplate and note down the colour is black.

In the field texture is determined by feel or rubbing the soil between the thumb and fingers. It is rapid procedure and proficiency is gained through experiment trial and with known textural class. 1) A small quantity of dry soil is moistened and mixed thoroughly on a glass or porcelain dish. 2) From this soil, a soft ball and then ribbon is formed. 3) While forming a ball and ribbon, note down the feeling by fingers, case of forming ball stickiness or grittiness whether forming soil ribbon or merely crumbing.

Soil temperature is an important parameter which affects the germination and establishment of the seedling. Soil thermometer was used for temperature measurement. The cone of soil is inserted up-to desired depth and note the reading directly on the item which is in open air.

Moisture percentage of soil is determined by taking fresh 100gm soil sample in pre-weighted beaker and placed it in oven for 24 hours at 70°C for drying. Weighing again the beaker possessing dry soil and calculated the moisture percentage.

Weight of empty beaker = 60gm

Weight of fresh soil = 100gm

Weight of dry soil + beaker = 128gm

Therefore weight of dry soil = 128 - 60 gm = 68gm

Moisture content of soil = 100 - 68 = 32gm

68gm of soil contain = 32gm of moisture

100 gm of soil will contain =  $32 \times 100 = 47.05\%$

Water holding capacity of soil is determined by allowing the soil sample to dry and taking a tin box with perforated bottom. Weighing the filter paper after placing the filter paper at the bottom of box fill the box gradually with soil. Placing soil filled box in a Petridis containing water allow it to remain together over night weight box once again. Placing the container in an oven at 105°C for 24 hrs. till constant weight is attained. Record the weight. Taking the few filter paper tip in outer and find out average water absorbed by the container. Repeated this procedure 5 times

Calculations :

Weight of dry filter paper = 6gm



**Weight of dry soil =5 gm**

**Weight of dry filter paper + weight of dry soil =0.6 + 5 =5.6 gm**

$$\left\{ \begin{array}{l} \text{weight of wet soil + weight of} \\ \text{dry filter paper} \\ = 9.25 - 5.6 = 3.65 \end{array} \right\} - \left\{ \begin{array}{l} \text{weight of dry soil + weight of dry} \\ \text{filter paper} \end{array} \right\}$$

**Therefore, water holding capacity**

**= Amount of water in soil**

**$\frac{\text{Weight of dry soil + Weight of dry filter paper}}{\text{Weight of dry soil + Weight of dry filter paper}} \times 100$**

**$\frac{3.65}{5.6} \times 100 = 65.17$**

**5.6**

**Electrical conductivity (EC) expresses ion contents of solution which determine the current carrying capacity thus giving a clear idea of the soluble salts present in the soil.**

**The electrical conductivity of a soil samples was determined on an Equiptronics digital electrical conductivity bridge for which 20g soil was added in 40ml distilled water. The suspension was stirred intermittently for half an hour and kept it for 30 minutes without any disturbances for complete dissolution of soluble salts. The soil was allowed to settle down and then conductivity cell was inserted in solution to take the reading to record the EC values.**

**pH value was determined by using electric pH meter, for this 10 gm of soil sample was mixed with 25 ml of distilled water and with help of glass rod shake the mixture to an hour.**

**Organic matter is useful in supplying nutrients and water to the plants and also provides good physical conditions to the plants. The quantity of organic carbon in the soil was estimated by using modified Walkey- black method (Walkey and black, 1934) as described by Jackson (1967). 1g finely ground dry soil sample was passed through 0.5mm sieve without loss and was taken into 500ml conical flask. To this 10ml of 1N potassium dichromate and 20ml con. H<sub>2</sub>SO<sub>4</sub> were added and the contents were shaken for a minute and allowed to set aside for exactly for 30 minutes and then 200ml distilled water, 10ml phosphoric acid and 1ml diphenylamine indicator were added. The solution was titrated against standard ferrous ammonium sulphate till colour changes from blue violet to green. The blank titration was also carried without soil.**

#### **RESULT AND CONCLUSION:**

**The studied soil sample from near the kapurwadi talav show variation in nature. Different physiochemical parameters found as follows. The colour of studied soil**

sample was black and black colour having considered and good quality for different crop production specially like cotton crops. Soil texture of given sample were recorded clay and loamy type. Temperature were recorded 20°C it may be due to collection season. Moisture percentage of sample were found about 47.05% as it considered as a good nature. 65.70% water holding capacity indicates good water holding capacity, commercial crop can be taken like sugarcane and vegetables are recommended for this nature.

Electrical conductivity value ranges to 0.35 at 25°C. Electrical conductivity is used to estimate the soluble salt concentrations in soil and is commonly used as a measure of salinity. An examination of soil samples (Table 1) shows that the values for pH range from 6.94 indicating that the soils are a neutral and hence appropriate value not acidic or basic that result into favourable conditions for all types of crops. The organic soil matter includes all the dead plant materials and live or dead animals. Most living things in soils, including plants, insects, bacteria and fungi, are dependent on organic matter for nutrients and energy. Soils have varying organic compounds in varying degrees of decomposition. The organic carbon range is 0.52%. Organic matter holds soils open, allowing the infiltration of air and water, and may hold as much as twice its weight in water. The organic carbon was 0.52% present. From all this studied parameter I come to the conclusion that the nature of soil is good for farming and specially for commercial crop.

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## Agriculture and Indebtedness

Shelke Digambar Sakharam\*, Pankar Anita Namedo\*\*

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### Introduction:-

In Indian economy agriculture is very important. On agriculture sector 2/3 population dependent and 19% GDP. The important of farm credit as acritical input to agriculture is reinforced by the unique role of Indian agriculture in the macroeconomics framework. India's development, the Government and the Reserve Bank of India have played a vital role. Agriculture policies have changing to maintain the requirements of the agriculture sectors. For Agriculture sector commercial banks have credit 18 per cent of net bank In 11 th Five year plan has set a target for the Agriculture sector within the overall GDP growth of 9 percent. So that for Agriculture sector affordable sufficient and timely supply credit to agriculture has critical importance.

From green revolution of the 1960 agriculture sector has made rapid strides and increase in farm production. For 1 billion people the Indian agriculture was provided food for that population. In future Indian agriculture have lot of serious problem affecting Indian agriculture. The Green Revolution has not necessarily translated into benefits for the lower in the economic in term of greater food security. Micro finance is a very vital role in Indian agriculture against poverty in rural areas. Dr. Yunus, a Nobel Prize winner and founder of Garmin Banklent small amounts of his privet money to the rural poor in Bangladesh in three decades ago.

Farmers need to production has provide short and long term credit to agriculture at suitable rate. The development in independent India the development process for production seasonal credit was perceived. For agriculture production of policy towards rural credit to provision sufficient rate of interest.

### 1) *Rural banking :-*

In agriculture sector the rural credit was born more than 100 years ago for crop loan and other supporting farmer level capital investment in agriculture.

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**Form Primary agriculture credit cooperative societies to meet the crop loan requirements with farmer and their members. In intermediate state cooperative banks and central cooperative banks as a prime Banks.**

**Primary agriculture credit bank has collect the deposits from its members and use the same for crop loans and to the needy members. Central cooperative bank has formed as small bank working in small towns to deposits from public and provide the same the same for needs. Central cooperative bank has also provide guidance and handling support to Primary agriculture credit bank. Capital adequacy and income recognition and asset have make them stronger by capitalization of public sector.**

## **2) Rural Indebtedness in India :-**

**Indebtedness has been acknowledged as one of the most infamous stumbling block in the way of rural property. A prudent strategy to break the circle would attack these weaker links. The task of the identification of the weaker links necessitates social research to be carried out. We must note that the problem of rural indebtedness is not sociological, economic or political problem in isolation it is a serious and crucial problem that has its roots in the social, political and economic texture of the society.**

## **3) Causes of Rural Indebtedness:-**

**Indian agriculture there are several factors responsible on account of which an agriculturist incurs debts remains indebted forever. It is the very socio- economic structure of the rural area which compels him borrow more and more. There is nothing wrong to borrow. He needs money to cope up his needs but his earnings from the farm is very low. He has to face many problems in his day to day work. Borrowing is very common phenomenon in the world but the fact is that Indian farmers are totally unable to return the amount of debt out of his meager income. Thus, indebtedness goes on multiplying year after year. Let us make a detailed investigation about the various causes of rural indebtedness.**

## **4) Population on Land:-**

**With the rapid rise in population especially in the rural areas the pressure of population on land is increasing day today. This has resulted in, the reduction of per capita income. Their meager income is not being enough for meeting the needs. Thus, farmers are forced to borrow.**

### **5) Unfavorable Climatic Conditions:-**

**Another cause of rural indebtedness is that Indian agriculture is still a gamble of rains. Frequent failures of monsoons result in droughts which badly affect crops. On the other hand, excessive rains cause havoc in the form of floods which damage crops. The failure of crops, whether partial or complete is a cruise on the lot of farmers braking their bones completely. Similarly other factors such as the raids of locusts, hailstorms, fire also effect the damage on crops. This means misery to farmers.**

### **Conclusion:-**

**There are several concerns in relation to rural credit which are generally expressed in terms of inadequacy, constraints on timely availability, high cost, neglect of small and marginal farmers, low credit deposit ratios in several states and continued presence of informal markets. It is held that while the commercial banks are more focused in improving efficiency and profitability, they have tended to give comparatively less priority to rural credit. Regional Rural banks and cooperative appear to face serious problems of governance as well as operational efficiency.**

### **Ref.:-**

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## Smart City Infrastructure Planning and Environment

Sonu R. Funde\*

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### Abstract :-

To study how the infrastructure can integrate with existing infrastructure Smart City and Environment. Smart city is an emerging concept. This concept is being used all over the world with different nomenclatures context & meanings. A smart city is a city that is well planned, and it provides the cost efficient services, environmental efficiency, and technological sound services for the welfare of the citizens. Smart solutions can be helpful in controlling the ever increasing population in the cities. Smart city approaches and applications, to provide a better understanding of the relevant framework, and to develop environmental recommendations. Environmental benefits and burdens, as well as economic and social impacts.

**Keywords :-** smart city, smart economy, smart energy, smart environment,

### Introduction :-

First we have know what is the smart city? What relation to an environment of smart city? what effect on the human health of smart city? due to the formation of smart city which area polluted? which dieses forms.



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**Smart City is a booming international phenomenon. Due to formation of smart city the government of India allocated INR70.6 billion for smart cities in Budget 2014-15. The predictions are based on an analysis of the Indian government's development, Bhandi Bazaar, a 16.5- acre site in Mumbai. Given the sheets scale of the development plan, the public resources would largely be insufficient and the government is working on envisaging new financing routes to boost program.**

**The six dimensions of a smart city are Smart Economy, Smart Mobility, Smart Environment, Smart People, Smart Living and Smart Governance. Every city can become smarter by focusing on any of the above dimensions. A smart city is a community that is efficient, sustainable & liveable. The term smart city has become more and more popular in the field of urban planning.**

***Description :-***

**Caragliu and Nijkamp 2009 :(Guest researcher in regional & urban economics at VU university Amsterdam.) "A city can be defined as 'smart' when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory action ... This scientist very well define the smart city but he does not show relation with environment, the smart city are related to environment. Because to make /produced these mega plane the government use big machinery they produced various earth pollution to make a big highway/roads. The government machinery is working on putting together the standards for exucating this mega plan, and identifying the cities of the developed in consultaion with states. A few smart cities are already coming up across the country, including Kochi Smart city, Gujrat International Finance, Tec-city (GIFT) in Ahmadabad, Naya Raipur in Chhattisgarh, Lawasa in Maharashtra and Wave Infratech's 4,500 – acre smart city near Delhi.**

**The Hon'ble Prime Minister Narendra Modi in June 2015, announced the fund to make a 'Smart Cities Mission' in India, 98,000 crore in 2015. Smart Cities Mission envisions developing an area within 100 cities in the country as model areas based on an area development plan, which is expected to have a rub-of effect on other parts of the city. In the 2014 Union budget of India, Finance Minister Arun Jaitley allocated 7,016 crore for the 150 smart cities.**



To develop the smart cities we create lots of pollutions of air, pollutions of water, pollutions of sound, pollutions of earth they are destroyed the human health. Smart City is a city in which you can get anything which we want there is no problem for anything in smart city there is new modern techniques and modern appliances and also the city is a developed City. Smart City there is a lot of pollution and it has many industries which can harm the water or our surroundings because of many people's of the Smart City come and settle in the city so that the everything which they needs so because of this that over population in a particular city. Due to formation of high housing, density, streets and concretes sideways, glass buildings- all of that creates a particular urban environment, in which there is not a lot of space for relaxing benefits of nature. The psychical characteristics of the city are feeding the problem. Things like that the heat, noise, artificial light are affecting us. To develop the smart cities we create lots of pollutions of air, pollutions of water, pollutions of sound, pollutions of earth they are destroyed the human health. Due to formation of high housing, density, streets and concretes sideways, glass buildings-



all of that creates a particular urban environment, in which there is not a lot of space for relaxing benefits of nature. The psychical characteristics of the city are feeding the problem. Things like that the heat, noise, artificial light are affecting us.

### **Conclusion:-**

The Smart city concept can be used for transforming any city into a smart city. Smart cities concept has gained a lot of attention lately and it will most likely continue to do so in the future. Cities are publishing smart plans , related conferences are trending and more books. Smart technologies can provide solutions for cities. Not so long ago, I wrote how the city's layout influences the environmental merits/demerits, economic success, pollutions, as well as human health of the city. The way of the streets are arranged and connected, has a very profound effect on many aspect of human life. And while this all sound good, we cannot help to think that there is something. The Smart cities must focus on reducing the volume of waste directed to landfills based on the 3'Rs' (Reduce,

**Reuse and Recycle) approach, involving a complete shift in the mindset of users from simple waste disposal to waste avoidance and prevention.**

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## Changes in Land Holding and Cropping Pattern in Maharashtra

Madhav H. Shinde\*

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### Introduction:

Agriculture sector is a prime sector of the economy. Any change in the sector has multiple effects on the economy. Agriculture sector provides raw material to industries and produces food for human being. The sector plays a vital role in employment generation. About 54 per cent population of the country directly depends upon agriculture sector. Moreover, the sector contributes 18 per cent of gross domestic product of the country. The sector also plays important role in country's export with 11.9 per cent share in India's total export. Production in agriculture sector has increased tremendously from 52 million tonnes in 1951-52 to 265 million tonnes in 2013-14. Agriculture sector in India has achieved this tremendous increase in the production because of the adoption of new variety of seeds, fertilizers, pesticides etc. under the green revolution programme during 1960s. This increase in the production of various crops has not only made India self-reliant in food grains but it also changed the tag of importing country to exporting country of food grains. India has achieved topmost position at international level in the production of various agricultural products such as rice, wheat etc.

Land holding pattern in India has also been changing as population of the country has increased in large amount. Though the small size of land holding has increased during the period 2001 to 2011, production of agriculture sector has increased significantly. Cropping pattern in India has been changing remarkably especially after the adoption of new economic reforms in 1991. The farmers in India have turned from traditional cropping pattern to modern or commercial crops.

Maharashtra is a one of the leading states in India. Agriculture sector of Maharashtra plays important role at national level. Horticulture sector in the state is performing well at national level. The state is largest producer of Mango, Grapes, Pomegranate, onion etc. crops. Land holding plays an important role in productivity of agriculture sector. Number of operational land holding upto 1.0 hectare has increased from 5305 thousand in 2001 to 6709 thousand in 2011 while, number of operational land holding between 1.0 to 2.0 hectare and 2.0 to 5.0 hectare has also increased from 3605 and 2652 thousand in 2001 to 4052 and 2473 thousand in 2011. On the other, number of operational land holding between 5.0 to 10.0 and 10.0 to 20.0 hectare has decline from 487 and 77 to 396 and 59

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during the same period. Besides, number of operational land holding of 20.0 and above hectare remained unchanged during the same period. Average size of land holding in Maharashtra declined significantly from 1.87 in 1995-96 to 1.44 in 2011.

**Table no. 01 Operational land holding and area in Maharashtra**

Size Class (ha.)	No. of Operational holding (000)		Area Operational Holdings (000 ha)		Average Size of Holding		
	2001	2011	2001	2011	1995-96	2001	2011
Upto 1.0	5305	6709	2648	3186	0.49	0.50	0.47
1.0 – 2.0	3605	4052	5127	5739	1.45	1.42	1.42
2.0 – 5.0	2652	2473	7780	7155	2.99	2.93	2.89
5.0 – 10.0	487	396	3208	2603	6.68	6.58	6.57
10.0 – 20.0	77	59	996	752	13.13	12.89	12.75
20.0 and above	9	9	341	332	39.95	36.75	36.89
<b>Total</b>	<b>12137</b>	<b>13698</b>	<b>20102</b>	<b>19767</b>	<b>1.87</b>	<b>1.66</b>	<b>1.44</b>

Source: Economic Survey of Maharashtra, Directorate of Economics and Statistics, Govt. of Maharashtra.

Area under various crops denotes the cropping pattern and it determines the production of the crop in the region. Area under some crops has been mentioned in the table no. 02. Cropping pattern of some of the crops under pulses and oilseeds is given in the table. Area under tur and soyabean has increased from 1096 and 1142 thousand hectares in 2001 to 1237 and 3702 thousand hectares in 2011 while area under other crops shows declining trend during the same period. Decline in the area under mung, udid, safflower and groundnut may be due to low market price for the products and unfavourable atmosphere in the state. New economic reforms adopted in 1991 opened the doors of the economy for foreign agri producers. New technologies, fertilisers and pesticides entered into the Indian market which has benefited the agriculture sector of India. Soyabean has emerged as a good optional crop for mung, udid, safflower and groundnut etc. crops in Maharashtra. Area under soyabean has increased significantly during 2001 to 2011 period. Area under total food grains has declined from 13382 thousand hectare in 2001 to 11210 thousand hectare in 2011. On the other area under cash crops like, oilseeds, horticulture, sugarcane etc. has increased during the same period. Increase in the area under horticulture crops during the period of 2001 to 2011 is significant which indicates the changing pattern of the state (table no. 03)

**Table No. 02 Area under Major Crops (000 ha.)**

Year	Tur	Mung	Udid	safflower	grndnut	Soya
2000-01	1096	676	574	296	490	1142
2004-05	1074	830	531	252	416	2102
2010-11	1302	554	482	173	395	2729
2015-16	1237	366	286	57	309	3702

Source: Economic Survey of Maharashtra, Directorate of Economics and Statistics, Govt. of Maharashtra.

**Table. No. 03 Area under Major Crops (000 ha.)**

Year	Total Foodgrains	Total Oilseeds	Total Horticulture	Sugarcane
2000-01	13382	2559	12770	595
2004-05	12595	3325	16476	327
2010-11	13023	3628	23243	965
2015-16	11210	4195	23694	987

Source: Economic Survey of Maharashtra, Directorate of Economics and Statistics, Govt. of Maharashtra.

**Table no. 04 Production of Major Crops**

Year	Tur	Mung	Udid	Safflower	Grndnut	Soya
2000-01	660	351	205	122	470	1266
2004-05	658	466	217	120	459	1892
2010-11	976	372	329	94	470	4316
2015-16	444	69	61	13	334	1795

Source: Economic Survey of Maharashtra, Directorate of Economics and Statistics, Govt. of Maharashtra.

**Table no. 05 Production of Various Crops (000 MT)**

Year	Total Foodgrains	Total Oilseeds	Total Horticulture	Sugarcane
2000-01	10133	2099	96.562	49569
2004-05	10531	2697	145.620	23914
2010-11	15413	5056	257.277	85691
2015-16	8328	2166	268.848	69235

Source: Economic Survey of Maharashtra, Directorate of Economics and Statistics, Govt. of Maharashtra.

Production figures of selected crops are given in the table no. 04 register increase in the production of soyabean crop only. The production of soyabean has increased from 1266 thousand MT in 2001 to 1795 thousand MT in 2011. Decline in the production of mung, udid, safflower and groundnut is a result of decline in the area under these crops. Broadly, production of total foodgrains declined while, the production of total horticulture has increased remarkably which describes effect of changing cropping pattern on the production of agriculture sector in Maharashtra. Finally, this data clearly indicates changing pattern and production of major crops in the state.

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Uncertainty and adequacy are the fundamentals characteristics of the indian monsoon. variations in the mansoon affect the agricultral production. However, the agricultural in maharashtra is camparatively developed in india. But at the same time, there have been huge amount of disparities in agrucultural development in the state. Adequate irrigation facilities are the prerequisite for the sustainable development of the sector. Over the year s there is increase in number of failure of indian mansoon. It is an outcome of the changing nature of climate and moreover, the increase in temperature of earth surface. I strongly believe that to come up with the problem we need along term constructive policy measure. As well as the people participation is the prerequisite while coping with the problem of climate change. I congratulate the orgniser for the conducting the academic discussion on this burning issue. The academic debate on this vital issue will be helpful for designing the long term policy on climate change and Agrarian Crisis. I wish greate success for these seminars.

**Hon'ble Dr. Rajendra Vikhe Patil**

Trustee And Secretery Pravara Medical Trust , Loni

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