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COMPARATIVE STUDY OF ORGANIC AND CONVENTIONAL FARMING METHODSAND ITS EFFECT ON THE SOIL PRODUCTIVITY IN DEORIA DISTRICT (U.P.)

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Abstract: ***The increasing human population and continuous shrinking in agricultural land had caused the introduction of modern farming techniques to increase the agricultural produce. During the late sixties the green revolution had inspired the farmers to maximize the use of chemical products which have given the desired results in the beginning. But soon after the nineties the effect of the chemical products started showing its true colour in decreasing the productivity of the soil and effecting human health by causing chronic health issues and thus mortality rate in common. This study is based on primary survey of 150 farmers of 7 villages (Rasauli, Kanhauli, Tendua, Siswa, Sonbarsa, Baraipar and Sahiya) of Deoria District. This paper is an attempt to find out the ill effect of conventional farming on the soil productivity and human health, and to give solution to cope up the problem.***

Key words- Organic Farming, Conventional Farming, productivity.

India is one of the agricultural based Nations with more than 58% of the population out of 1.34 billion, pertaining to agricultural sector. Before 1960, in India only organic farming practice was followed without chemical fertilizers and pesticides. During late 1960s, there was threatening to food security due to population raise and frequent droughts. Government of India had entered collaboration with USA for reforming farming practices by adding chemical products for cultivation, diseases and weed management. There was increase in production and productivity in the conventional farming and our country was able to satisfy partly the food security.

Till the start of the nineties the use of chemical fertilizer, pesticide and genetically modified seeds became very common among the farmers all over India, and has become the conventional methods of farming. These high input production systems requiring massive quantities of chemical fertilizers, pesticides, irrigation and machines, however, disregard the ecological integrity of land, forests and water resources, endanger the flora and fauna and cannot be sustained over generations. Green revolution technologies have more than doubled the yield potential of rice, wheat and even other crops and vegetables in our country. But after 55 years, production and productivity reduced drastically with abnormal input costs and the farming sector turned to be unfavorable occupation to all concerned. Soil degradation, more diseases, uncontrollable weeds, high water consumption, unfavorable price and with several natural and manmade issues, conventional farming turned to be unworthy for farmers.

The excessive use of chemical fertilizers and pesticides has led to the accumulation of harmful chemicals and toxics in the soil. These harmful products concentrates in the crops and vegetables grown in that soil, which is also termed as 'Bio-magnifications and thus causes the chronic health issues such as colon cancer, prostate cancer, hypertension, diabetes, blood cancer, kidney failure etc.

STUDY AREA- Deoria district is situated in the north eastern part of Uttar Pradesh. Formerly it was a tehsil of Gorakhpur district but got separated in 1946 as the independent district. The study area extends from 26°6' N and 26° 48' N latitudes to 83° 23' Eand 84° 16' E longitudes. It has a total area of 2527.2 sq. km. In the north, the study area is bounded by the District Kushinagar while the districts of Ballia and Azamgarh of Uttar Pradesh form its Southern boundary. In the east, it is delineated by the UttarPradesh-Bihar border across which lie the West Champaran, Gopalganj and Siwan districts of Bihar. Gorakhpur district, from which the study area has been separated, forms its Western boundary. The river Ghagara flows along the southern boundary onealong the southern boundary of the district.

According to the 2011 census Deoria district has a population of 3,098,637, roughly equal to the nation of Mongolia or the US state of Iowa. This gives it a ranking of 114th in India (out of a total 640). The district has a population density of 1,220 inhabitants per square kilometer (3,200/sq mi). Its population growth rate over the decade 2001-2011 was 14.23%. Deoria has a sex ratio of 1013 females for every 1000 males, and a literacy rate of 73.53%.

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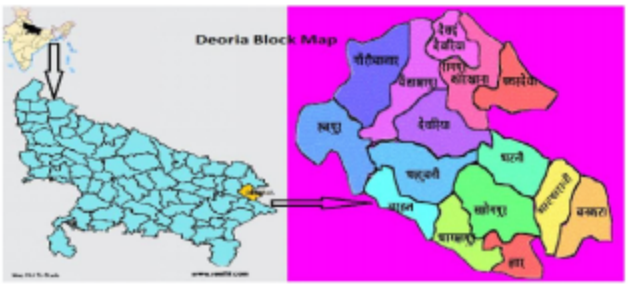

METHODOLOGY: This paper is based on the primary survey of 150 farmers of 7 villages (Rasauli, Kanhauli, Tendua, Siswa, Sonbarsa ,Baraipar and Sahiya) of Deoria District, which is usually collected by the questionnaire and through the individual interviews. The information about the nutrients of the soil is collected from the National Bank for Agriculture and Rural Development and also from the experiences The secondary data is collected from the NGO's working for the extension of the organic farming in Deoria District and through the reviewed published sources like the websites of the European Union countries, International Federation of Organic Farming Movements (IFOAM), books and periodicals. The approach to analyze the agricultural data is ecological and the methodologies used are both observational descriptive and observational relational, during the whole research work in absence of data at some places hypothetical method is also applied to get the desired result.

OBJECTIVE OF THE STUDY:

1. To understand the need for organic farming in Deoria District.
2. To assess and evalunte the factors which may facilitate the adoption of organic farming in theDistrict
3. To analyze the modern farming methods and to evaluate the effect of these methods on the soilproductivity in Deoria District.

A COMPARATIVE STUDY OF THE FARMING METHODS IN AN ECOLOGICAL PROSPECT: In a comparative study of organic and conventional agriculture in Deoria district should be several points of focus: production, biodiversity, soil composition, erosion, water use and energy use. The environmental impact and production levels of each method will determine its overall viability as a solution to growing trends. It is necessary to make these comparisons in order to identify the best agricultural method that can sustainably meet the needs of the current population. Although these comparisons are based on scientific data, there is much more research that needs to be done in order to make a definitive judgment.

To meet the needs of the current population requires a tremendous amount of resources. Not taking into account the environmental damage associated with intense production, conventional agriculture is a feasible way to provide for more people; "... population growth and increasing consumption of calorie- and meat-intensive diets are expected to roughly double human food demand by 2050." (Mueller, Gerber, Johnston, Ray, Ramankutty, and Foley 2012). In addressing this rapid growth, production levels become a serious point of comparison. "Organic yields are globally on average 25% lower than conventional yields according to a recent meta-analysis, although this varies with crop types and species and depends on the comparability of farming systems." (Gabriel, Salt, Kunin, and Benton 2013). Most research indicates that organic crops produce much less than conventional systems.

There are many environmental benefits associated with organic agriculture, but its production capacity is limited. In general, organic agriculture fails to match up to conventional agriculture in terms of production. This result varies though, and in some instances organic crops actually are the best crops. For example, under drought conditions organic crops tend to produce higher yields because they typically retain more water; "As part of the Rodale Institute Farming System Trial (from 1981 to 2002), Pimentel et al., (2005) found that during 1999, a year of extreme drought, (with total rainfall between April and August of 224 mm, compared with an average of 500 mm) the organic animal system had significantly higher corn yield (1,511 kg per ha) than either organic legume (412 kg per ha) or the conventional (1,100 kg per ha)." (Gomiero, Pimentel, and Paoletti 2011). Although certain conditions may favor organic

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crops, conventional agriculture is designed to produce the highest yields possible.

Many factors contribute to this difference in production. Conventional crops are designed specifically to produce maximal yields; therefore, the difference should be expected. Typically conventional crops are genetically modified to perform better under certain conditions than organic crops (Carpenter 2011). However, these crops are also sprayed with toxic pesticides and herbicides to make up for their uniformity. Some research has been done to determine whether increased biodiversity is related to increased yields; "...farmland biodiversity is typically negatively related to crop yield; generally, organic farming per se does not have an effect other than via reducing yields and therefore increasing biodiversity." (Gabriel, Salt, Kunin, and Benton 2013). Although levels of production are reduced in organic agriculture, studies show that higher levels of biodiversity are linked to healthier crops. Biodiversity plays a large part in this comparison because it is a determinant of agricultural health and performance. The greater the biodiversity, the more immune plants are to pests and disease (Gomiero, Pimentel, and Paoletti 2011). This is important to highlight because conventional agriculturediscourages biodiversity and instead relies on synthetic chemicals to maintain crop health. Over 940 million pounds of pesticides are being appliedannually with only only 10% of that reaching the desired target, a number that could be greatly reduced ifconventional agriculture were to implement organic alternatives (Organiclafayette.org). Techniques such as integrated pest management and intercropping could be applied to conventional systems and in turn promote biodiversity. High biodiversity is important to organic farming because it enhances the performance of the ecological cycles that the crops depend upon. Organic agricultural systems are typically much more rich in nutrients and diverse in organisms than conventional systems, ".organic farming is usually associated with a significantly higher level of biological activity, represented by bacteria, fungi, springtails, mites and earthworms, due to its versatile crop rotations, reduced applications of nutrients, and the ban on pesticides." (Gomiero, Pimentel, and Paoletu 2011). It is important to encourage high nutrient levels and biodiversity as these two factors contribute significantly to the health of the crops and the landscape. Although biodiversity does not directly determine crop yield, it does play a major role in the health and permanence of organic farms.

In addition to higher levels of biodiversity, organic farming is typically associated with better soil quality. Organic farms have stronger soil ecology because they promote biodiversity rather than uniformity: "The results confirm that higher levels of total and organic C, total N and soluble organic C are observed in all of the organic soil." (Wang, Li, and Fan 2012). The increased concentrations of these nutrients can be contributed to the depth of the food web and amount of biomass in organic systems. "In a seven-year experiment in Italy, Marinari et al. (2006) compared two adjacent farms, one organic and one conventional, and found that the fields under organic management showed significantly better soil nutritional and microbiological conditions; with an increased level of total nitrogen, nitrate and available phosphorus, and an increased microbial biomass content, and enzymatic activities. (Gomiero, Pimentel, and Paoletti 2011). Organic crops are more permanent than conventional crops because they work in harmony with the landscape rather than drain it of nutrients and biomass.

Soil management is vital for existing farms because agricultural production is increasing globally and land is becoming less available to accommodate this growth. Conventional systems can improve soil quality by practicing organic methods like no-tillage farming, agro forestry, and integrated pest management, but organic agriculture is the most effective form of food production in terms of maintaining soil conditions. "Establishing trees on agricultural land can help to mitigate many of the negative impacts of agriculture, for example by regulating soil, water and air quality, supporting biodiversity, reducing inputs by natural regulation of pests and more efficient nutrient cycling, and by modifying local and global climates." (Smith, Pearce, and Wolfe 2012). Again, research shows that an increase in biodiversity and a reduction of chemical input can result in conventional farms with more healthy soils and improved crop performance.

A major problem concerning agriculture is soil erosion caused by nutrient loss, run-off, salinity, and drought. Soil erosion presents a threat to the growth of agriculture because, "Intensive farming exacerbates these phenomena, which are threatening the future

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sustainability of crop production on a global scale, especially under extreme climatic events such as droughts." (Gomiero, Pimentel, and Paoletti 2011). Organic systems enhance soil composition as well as prevent soil erosion due to the greater amount of plant material and biomass in the soil. Conventional systems manipulate the landscape rather than adapt to it; "...soils under organic management showed <75% soil loss compared to the maximum tolerance value in the region (the maximum rate of soil erosion that can occur without compromising long-term crop productivity or environmental quality - 11.2 t ha- yr-), while in conventional soil a rate of soil loss three times the maximum tolerance value was recorded." (Gomiero, Pimentel, and Paoletti 2011). Compared to organic farming, conventional crops are terribly inefficient at maintaining the integrity of agricultural landscapes. Conventional agriculture is therefore unable meet the demands of the growing populations without consuming a substantial amount of land and nonrenewable resources.

COMPARATIVE ANALYSIS OF ORGANIC AND CONVENTIONAL FARMING ON SOIL PRODUCTIVITY: A comparative analysis is done on the basis of data collected from the experiences of farmers during the interview and the soil test report clearly indicates that the conventional farming systems have greatly increased crop production and labour efficiency. But, serious questions are being raised about the energy-intensive nature of these systems and their adverse effects on soil productivity and environmental quality. This concern has led to an increasing interest in organic farming systems because they may reduce some of the negative effects of conventional agriculture on the environment. We compare the effects of organic and conventional-farming on selected properties of the same soil. The organically farmed soil had significantly higher organic matter content, thicker top soil depth, polysaccharide content (biomass), lower modulus of rupture and less soil erosion than the conventionally farmed soil. This study indicates that, in the long term organic farming system is more effective than the conventional farming system in reducing soil erosion and, therefore, in maintaining soil productivity.

Organic farming differs from conventional farming mainly in tillage methods, crop rotations, fertilizer applications, and pest control methods. Whereas conventional farming systems depend on chemical fertilizers and pesticides, organic farming systems avoid or largely exclude their use by relying upon crop rotations, manure, mechanical cultivation, organic fertilizers and biological pest control to maintain soil productivity, supply plant nutrients and control pests.

To analyze and compare the overall soil productivity of organic and conventional farming some sample of soil from different agricultural farms in Deoria District were taken to test in the laboratory and the farmers were also interviewed to collect the first hand information from their experience. The study clearly reveals that the surface layer of the organically-farmed soil was darker than the surface layer of the conventionally-farmed soil, indicating significantly higher organic matter levels in the organically-farmed soil. Organic matter has a profound impact on soil quality; it encourages granulation, increase water storage, nutrient supply, and soil organism activity, and improves soil fertility and productivity. Another test also showed that the organically-farmed soil also had significantly higher levels of soil enzymes and significantly higher microbial biomass in comparison to conventionally-farmed soil. Soil micro organisms serves as active binding agents in soil aggregate formation, and are involved in aggregate stability.

Moisture contents were significantly higher in the organically-farmed soil than in the conventionally-farmed soil, which may be attributed to the higher organic matter levels of the organically-farmed soil. The organically-farmed soil had a significantly lower modulus of rupture (hardness of surface crusting), indicating that seedling emergence could be enhanced in the organicallyfarmed soil.

The surface horizon of the organically-farmed soil was significantly thicker than the surface horizon of the conventionally-farmed soil. These differences, especially the large difference in topsoil depth, are attributed to significantly greater soil losses due to erosion on the conventionally-farmed. Erosion not only reduces the surface horizon thickness but also, more significantly, brings the subsoil layer nearer to the surface. Despite the higher erosion rate of the conventionally-farmed Naff soil, its surface horizon thickness was thinner than that of the organically-managed soil. This was due to its continual mixing by plough, and the addition of fresh

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organic matter from crop residues. So the amount of productive topsoil was dramatically less on the conventionally-farmed soil. This loss of topsoil was due to water and tillage erosion. Loss of topsoil by erosion has been shown to reduce organic matter, fine clays, available water-holding capacity, plant root depth, soil productivity and crop yields. The difference in erosion rates between the organic and conventional farms was most probably due to their different crop rotation systems. Only the organic farm included a green manure legume crop in the third year of rotation and it fewer tillage operations.

RESULT & FINDINGS: In this research paper after analyzing the data collect from the different sources the following resultsand findings are derived:

1. The conventional farming may be a feasible way to provide the growing population but when used for the long term it has deteriorated the soil productivity but the organic farming provides the environmental benefits.
2. Organic farming fails to match up to conventional farming in many instances but it produce higher.
3. Organic farming increases the moisture holding capacity of the soil comparatively to the conventionalfarming.
4. Conventional crops are genetically modified so discourages biodiversity and immunes plants to pestsand diseases.
5. Organic farming encourages biological activity and versatile crop rotations which is just opposite tochemical fertilizer and pesticides to increase the crop yield.
6. Organic crops are more permanent than conventional crops because they work in harmony with thelandscape rather than drain its nutrients and biomass.
7. Organically farmed soil maintains the soil temperature as high biomass content presents in the soildue to the use of green manure in the farm which also helps the soil in retaining moisture.
8. Organic farming system is more effective than the conventional farming system in reducing soilerosion and, therefore, in maintaining soil productivity.
9. Organically-farmed soil is indicating significantly higher organic matter levels.
10. Organically-farmed soil also had significantly higher levels of soil enzymes and significantly highermicrobial biomass in comparison to conventionally-farmed soil.
11. Organically-farmed soil was significantly thicker than the conventionally-farmed soil, thesedifferences, attributed to significantly greater soil losses due to erosion on the conventionallyfarmed.

CONCLUSION: The study points to the Organic agriculture as the best solution to manage the growing population and their overall health. Although the benefits of organic agriculture are abundant, there are several constraints to adopting this method in Deoria District. Most important thing is the unawareness and misconception for the organic farming. "Some authors suggest the adoption of integrated farming, rather than upholding solely organic practices, which they find more harmful than conventional farming, for instance in the case of pest control technologies." (Gomiero, Pimentel, and Paoletti 2011). Many factors determine the performance of agricultural methods and often the most effective type of agriculture requires a combination of techniques. In addition to local constraints, organic agriculture also requires much more labor to maintain crops.

The science of agriculture has allowed human populations to grow exponentially and dominate the world's landscapes. Advancements in this science have enabled humans to manipulate entire ecosystems to cater to their survival. But as populations continue to grow, resources are becoming limited. Water, fuel, and soil are three important factors determining the survival of the population and it is crucial that they are used as efficiently as possible. In a comparison of organic and conventional agriculture, organic farming methods are shown to perform much better for a number of indicators. Organic agriculture consumes less water and energy, enhances soil composition, and forgoes synthetic chemical input. Conventional agriculture cannot meet the needs of the current population without compromising the integrity of the environment. Organic agriculture has the potential to sequester carbon, feed the world, and enrich the environment. The social, economic, andenvironmental benefits of this system are reasons why organic agriculture is the most viable way to accommodate growing trends.

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